Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(6): 1486-1489
Received: 17-09-2018
Accepted: 19-10-2018

K Madhusudhan Reddy
College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University, Hyderabad, Telangana, India

P Saidaiah
College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University, Hyderabad, Telangana, India

Harikishan Sudini
International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Hyderabad, Telangana, India

A Geetha
Regional Agricultural Research Station, Professor Telangana State Agricultural University, Palem, Nagarkurnool, Telangana, India

K Ravinder Reddy
College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University, Hyderabad, Telangana, India

Correspondence
K Madhusudhan Reddy
College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University, Hyderabad, Telangana, India

Benefit cost ratio of different storage bags used for control of aflatoxins in dry chillies

K Madhusudhan Reddy, P Saidaiah, Harikishan Sudini, A Geetha and K Ravinder Reddy

Abstract
The experimental results on storage of dry chillies in different storage bags against *Aspergillus flavus* showed that the benefit cost ratio calculated for all the treatments showed that triple layer PICS bag at 6 months storage period has highest benefit cost ratio (1.10) followed by triple layer PICS bag at 4 months storage period (1.05) and triple layer PICS bag at 2 months storage compared to all other types of storage bags used for storage. So, the farmers are encouraged to use the PICS bags for safe storage of dry chillies for efficient control of aflatoxin and maintenance of seed quality.

Keywords: Aflatoxins, *Capsicum annuum*, chillies

Introduction
Chilli (*Capsicum annuum* L.) is an important commercial spice-cum-vegetable crop belongs to the family solanaceae, having chromosome number 2n=24 and originated in South America. It is grown in India under various agro climatic conditions *viz.*, tropical, sub- tropical and temperate climates (Hazra *et al*., 2011) [7]. Chillies are produced in countries with tropical climates that have high range of temperature, humidity and rainfall. India is the major producer, consumer and exporter of chilli, covering an area of 0.774 million hectares with a production of 1.492 million tonnes averaging a productivity of 1.93 tonnes per hectare (Anon., 2015) [1]. The crop suffers in the field as well as in storage losses. Traditionally, red chillies are spread out on the surface of ground/polythene sheets/concrete floors to dry in the open air, where the climatic conditions are ideal for growth of molds and production of myco toxins. Quality regarding aflatoxin also depends on drying (Magan *et al.*, 2004) [6]. Fresh picked chillies have unsafe moisture content which results in heating of the fruit and rapid deterioration. To avoid microbial activity and aflatoxin production, the moisture content in dried pods should not exceed 10 per cent by weight (Williams *et al*., 2014) [15]. There are two methods of drying i.e., sun drying (natural drying) and artificial drying (mechanical drying).
During the dry season, sun drying is usually simplest and cheapest method to dry chillies. In this method the produce is spread on an open floor or roof of the building and exposed to sun for 10–15 days. However, some problems are associated with this method. Dust or dirt is blown onto the crop which contaminates and unexpected rainstorms can re-wet the produce, which activates microbial activity and ultimately aflatoxin contamination (Udoh *et al.*, 2000) [10]. Triple layer plastic bags developed recently by Purdue University, USA under the Bean/Cowpea Collaborative Research Support Program (CRSP). These triple layer plastic bags provided an improved alternative for insecticide-free (De Lima, 1990, White and Jayas, 2003) [3, 14] long-term storage of common beans with minimal grain damage (Murdock *et al*., 2003). Triple layer plastic bags consists of three layers; inner and middle layers were made up of 80 micron thickness high density polyethylene (HDPE) material and do not allow diffusion of gases (Oxygen and Carbon dioxide) while the outermost layer is a normal woven sac made up of polypropylene and provides strength for handling. Triple layer bag leads to hypoxia (reduced levels of oxygen) and hypercarbia (increased levels of carbon dioxide) conditions (Weyel and Wegener, 1996) [13]. Triple layer bag can control the myco toxin development (Bulaong and Dharmaputra 2002) [2]. Keeping the above in view, the present experiment was planned to calculate BC ratio of dry chillies stored in different bags.

Material and Methods
To know the efficacy of PICS bags on seed quality parameters of dry chillies and *Aspergillus flavus* control, the research investigation was carried out from for six months from September, 2017 to March, 2018 in the research laboratory of SKLTSHU, Rajendranagar

Hyderabad, Telangana, India. The experiment was laid out in by CRD with two factors: four types of bags (Factor A) *i.e.* jute bag, polythene bag, triple layered PICS bag and jute bag treated with mancozeb and three storage periods (Factor B) *i.e.* 2 months, 4 months and 6 months. Each treatment contained healthy dried chillies (of LCA 625) @ 5 kg/bag. Each of these bags will be infected with spore suspension of *A. flavus* toxigenic strain (AF 11-4) @ 15 ml/bag.

Benefit Cost Ratio

The benefit cost ratio is calculated based on cost of all inputs before starting the experiment (Table 1) and profit gained by selling the final produce after the experiment *i.e*, at the end of the storage periods 2, 4 and 6 months duration (Table 2) by using the formula

$$BCR = \frac{TR}{TC}$$

Where,
BCR = Benefit cost ratio
TR = Total revenue
TC = Total initial cost of production

Table 1: Particulars and its cost used for calculation of B: C Ratio of the experiment

S. No.	Particulars		Cost/Kg/Bag
1	Initial dry chilli cost/kg		Rs. 68
2	Chilli cost at 2 months	Stored in jute bag	Rs. 40
		Stored in polythene bag	Rs. 50
		Stored in PICS bag	Rs. 85
		Stored in jute bag treated with fungicide	Rs. 45
3	Chilli cost at 4 months	Stored in jute bag	Rs. 30
		Stored in polythene bag	Rs. 40
		Stored in PICS bag	Rs. 95
		Stored in jute bag treated with fungicide	Rs. 35
4	Chilli cost at 6 months	Stored in jute bag	Rs. 20
		Stored in polythene bag	Rs. 30
		Stored in PICS bag	Rs. 100
		Stored in jute bag treated with fungicide	Rs. 25
5	Cost of jute bag		Rs. 30
6	Cost of polythene bag		Rs. 20
7	Cost of PICS bag		Rs. 100
8	Cost of fungicide		Rs. 105
9	Cost of fungicide for 2 ml used		Rs. 1
10	Cost of storage of dry chillies per month		Rs. 2
11	Cost of transport		Rs.750
12	Cost of transport per 5 kg		Rs.8

Table 2: Effect of different types of storage bags on benefit cost ratio of dry chilies at different storage periods

Bag type with storage period (months)	Initial cost of dry chilli (Rs/kg)	Bag cost (Rs/bag)	Chemical cost (Rs/bag)	Transport cost (Rs/bag)	Total initial cost for 5 kg dry chilli/bag (rps/bag)	Weight of bag before storage (kg)	Final weight of bag after storage (kg)	Selling cost of chilli after storage /kg (rps)	Total selling cost /bag after storage	Storage cost (Rs/bag /month)	Total cost (Rs/bag)	Benefit	B/C ratio
Benefit cost ratio for jute bag at different storage periods													
Jute bag (2 months)	68	30	-	8	340	5	4.1	40	164	2	380	-216	0.43
Jute bag (4 months)	68	30	-	8	340	5	4.0	30	120	4	382	-262	0.31
Jute bag (6 months)	68	30	-	8	340	5	4.0	20	80	6	384	-304	0.20
Benefit cost ratio for polythene bag at different storage periods													
Polythene bag (2 months)	68	20	-	8	340	5	4.6	50	230	2	370	-140	0.62
Polythene bag (4 months)	68	20	-	8	340	5	4.6	40	184	4	372	-188	0.49
Polythene bag (6 months)	68	20	-	8	340	5	4.5	30	135	6	374	-239	0.36
Benefit cost ratio for triple layer plastic bag at different storage periods													
Triple layer bag (2 months)	68	100	-	8	340	5	5	85	425	2	450	-25	0.94
Triple layer bag (4 months)	68	100	-	8	340	5	5	95	475	4	452	23	1.05
Triple layer bag (6 months)	68	100	-	8	340	5	5	100	500	6	454	46	1.10
Benefit cost ratio for jute bag treated with fungicide at different storage periods													
Jute bag treated with fungicide (2months)	68	30	1	8	340	5	4.4	45	198	2	381	-183	0.51
Jute bag treated with fungicide (4months)	68	30	1	8	340	5	4.3	35	150	4	383	-233	0.39
Jute bag treated with fungicide (6months)	68	30	1	8	340	5	4.2	25	105	6	385	-280	0.27

The revenue obtained by selling the produce depends on the quality of the produce. The produce with heavy *Aspergillus flavus* infection fetched less price and produce with good quality fetched premium price in the market.

Results and Discussion

The effect of storage bags, on benefit cost ratio of dry chillies at different storage periods is presented in Table 3 and illustrated in Fig 1. Maximum benefit cost ratio triple layer PICS bag stored for 6 months storage period (1.10), followed by triple layer PICS bag stored for 4 months storage period (1.05), triple layer PICS bag stored for 2 months (0.94).

In triple layer PICS bag the initial cost is higher compared to other traditional storage bags which caused to lower the benefit cost ratio, even though benefit cost ratio is more for triple layer PICS bags. Isnfection of *Aspergillus flavus* is less and there is no further loss of stored produce due to infection of fungus as all the molds in the triple layer PICS bag

(Waliyar *et al.*, 2015) [12], might have dead and no further loss of weight in dry chillies and no reduction in benefit cost ratio of triple layer PICS bag with storage. The produce stored in the triple layer PICS bag is good in quality compared to other traditional bags used for storage and fetch the good market price which benefits the farmers.

Compare to other traditional storage bags triple layer PICS bag can avoid initial infection of produce by fungus as it contains triple layers (Nesci *et al.*, 2011) [8], other bags cannot avoid the initial infection of produce by the fungus, as the bags are porus and cannot avoid the entry of oxygen into the bag. So the triple layer PICS bag is best compare to other traditional bags, which is chemical free and no chemical cost is incurred in the treatment like that of jute treated with insecticide, no health risk of using chemical, ease of handling, no skill is required and only following some precautions while using the triple layer PICS bag without any damage can control the infection where other bags cannot control, and can be reuse multiple times by proper handling. Handling of triple layer PICS bag is also simple which the farmer can use it (Vales *et al.*, 2014) [11].

Triple layer PICS bag effectiveness was evaluated comparing with the other three farmers traditional storage practices (Sudini *et al.*, 2015) [12] like jute bag, polythene bag and jute bag treated with fungicide with different storage periods like 2 months storage period, 4 months storage period and 6 months storage period. Initially all the bags contained 5 kg of dry chillies. Each of these bags will be infected with spore suspension of *A. flavus* toxigenic strain (AF 11-4) @ 15 ml/bag. Each bag considered as treatment and a total of 12 treatments replicated thrice. The benefit cost ratio of different treatments are also calculated at the end of each storage period.

Table 3: Effect of different types of storage bags on benefit cost ratio of Dry chillies at different storage periods

Benefit Cost ratio (B:C)		Different storage periods: Factor B		
		2 Months (B_1)	4 Months (B_2)	6 Months (B_3)
Bag type: Factor A	Jute bag (A_1)	0.43	0.31	0.20
	Polythene bag (A_2)	0.62	0.49	0.36
	Triple layer PICS bag (A_3)	0.94	1.05	1.10
	Jute bag treated with insecticide (A_4)	0.51	0.39	0.27

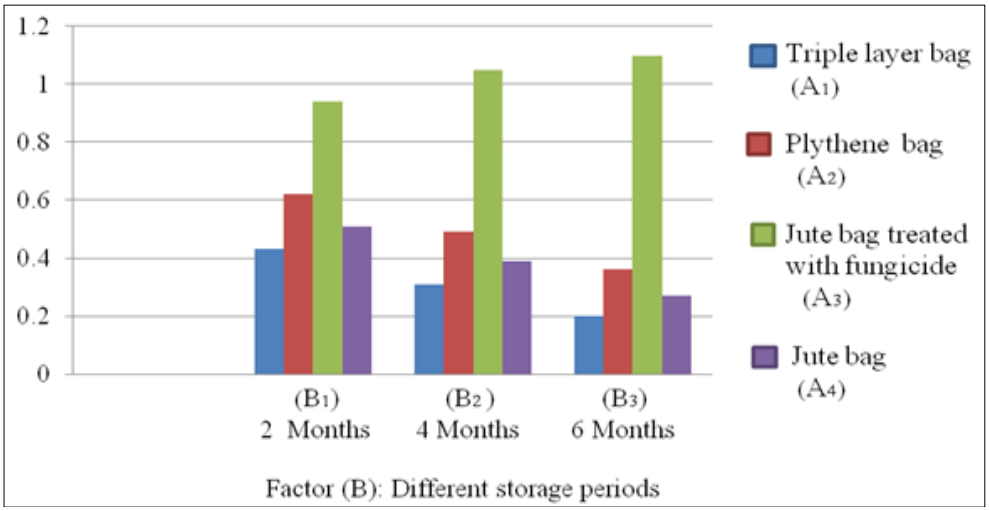

Fig 1: Effect of storage bags on change in benefit cost ratio of dry chillies at different storage periods

The B: C ratio of different treatments showed the maximum B:C ratio in the triple layer PICS bag as the infection was less, the quality of dry chillies was high compared to other storage bags used. Even though the initial cost of bag was high in the triple layer PICS bag but there was no additional cost of chemical are required as in the jute bag treated with insecticide. Hence there was no further damage of chillies with increased duration of storage. After the periods of storage, the quality of seed fetched the premium price in the market. The triple layer PICS bag can also use for multiple times (Jones *et al.*, 2011) [5] over seasons without any damage is added advantage.

References

1. Anonymous. Area and Production of Vegetable Crops in India. Indian Horticulture Database. National Horticulture Board, 2015.
2. Bulaong SSP, Dharmaputra OS. Fungal population, aflatoxin and free fatty acid contents of peanuts packed in different bag types. Bio tropia. 2002; 19:1-25.
3. De Lima CPE. Airtight storage: principles and practices. In: Calderon, M., Barkai-Golan, R. (Eds.), Food Preservation by Modified Atmospheres. *CRC* Press, Boca Raton, Florida, 1990, 9-19.
4. Hazra P, Chattopadhyay A, Karmakar K, Dutta S. Modern technology in vegetable production. New India Publishing. Agency, New Delhi, India, 2011, 478
5. Jones M, Alexander C, DeBoer JL. An Initial Investigation of the Potential for Hermetic Purdue Improved Crop Storage (PICS) bags to improve incomes for maize producers in Sub-Saharan Africa, 2011, 44.
6. Magan N, Sanchis V, Aldred D. Role of spoilage fungi in seed deterioration. Chapter 28, In Fungal Biotechnology in Agricultural, Food and Environmetal Applications ed. Aurora, D.K. New York: Marcell Dekker, 2004, 311-323.
7. Murdock LL, Seck D, Ntoukam G, Kitch L, Shade RE. Preservation of cowpea grain in SubSaharan Africa – Bean/Cowpea CRSP contributions. Field Crops Res. 2003; 82:169-178.

8. Nesci A, Montemarani A, Etcheverry M. Assessment of mycoflora and infestation of insects, vector of *Aspergillus section Flavi*, in stored peanut from Argentina. Journal of Stored Products Research. 2011; 27(1):5-12.
9. Sudini H, RangaRao GV, Gowda CLL, Chandrika R, Margam V, Rathore A, *et al*. Purdue Improved Crop Storage (PICS) bags for safe storage of Groundnuts. Journal of Stored Products Research. 2015; 64(B):133-138.
10. Udoh JM, Cardwell KF, Ikotun T. Storage structures and aflatoxin content of maize in five agro ecological zones of Nigeria. Journal of Stored Products Research. 2000; 36:187-201.
11. Vales MI, RangaRao GV, Sudini H, Patil SB, Murdock LL. Effective and economic storage of pigeonpea seed in triple layer plastic bags. Journal of Stored Products Research. 2014; 58:29-38.
12. Waliyar F, Osiru M, Ntare BR, Kumar KVK, Sudini H, Traore A, *et al*. Post-harvest management of aflatoxin contamination in groundnut. World Mycotoxin Journal. 2015; 8(2):245-252.
13. Weyel W, Wegener G. Adenine nucleotide metabolism during anoxia and post anoxic recovery in insects. Experientia. 1996; 52:474-480.
14. White NDG, Jayas DS. Controlled atmosphere storage of grain. In: Chakraverty A; Majumdar A S; Raghavan G S W; Ramaswamy H S (Eds.). Handbook of Postharvest Technology. Cereals, fruits, vegetables, tea and spices, 2003, 235-251.s
15. Williams SB, Baributa D, Woloshuk C. Assessing purdue improved Crop Storage (PICS) bags to mitigate fungal growth and aflatoxin contamination. Journal of Stored Products Research. 2014; 59:190-196.