Thailand coffee bag liner storage trial

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Storage bags are commercially available from:
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Note: A Thai language version of this report is also available.

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Summary

A coffee storage trial was conducted at the Chumphon Horticulture Research Centre (CHRC), in south Thailand where polyethylene bag liners designed to reduce re-absorption of moisture by rice in storage were trialled to evaluate the impact on coffee quality after long term coffee storage. Four forms of coffee were stored for a period of 9 months in the 50 kg polyethylene bag liners. The forms of coffee stored were dry cherry, dry parchment, split cherry coffee and green bean. Four control samples of the same coffee were stored in 4 traditional woven polypropylene sacks. All samples were stored in a naturally ventilated store.

No "off" flavours were found in any of the 8 samples, indicating that both storage types for the 4 forms of coffee were acceptable. The two samples stored as dry cherry were found to retain the harsher typical flavour associated with fresh Robusta. These two samples were closest in cup taste to the control sample of new season Robusta. The results showed that storage in the form of dry cherry tends to preserve the original harsh Robusta coffee flavour.

There were no significant changes in the bean-infecting fungi in the stored coffee over the nine months of this study. There was no indication in this trial that storage in normal ambient Thai conditions over nine months leads to any problems caused by fungi, if the products are placed into storage at 12% moisture content.

▲ Coffee in Storage

▲ 50 kg polyethylene bag liners

Traditional woven polypropylene sacks ▶

Introduction

Robusta coffee is grown in southern Thailand at low altitudes of usually less than 200m. a.s.l. Harvest in part coincides with the rainy season and conditions for Natural drying of cherry are often wet and less than ideal. As a result coffee often gets re-wet during traditional patio sun drying of cherry and produces poor quality coffee with off-flavours and moulds and may be contaminated with Ochratoxin A (OTA). A survey of 94 farms has recently found presence of OTA in around 73% of dried cherry green and bean samples with 14% of those with levels of OTA of 5 ppb of less. A maximum of 12ppb OTA was found in one sample.

Reduction of general coffee quality along with increased fungal growth and OTA contamination of dry coffee may also be related to the on-farm storage conditions of dry coffee in Thailand due to re-absorption of moisture and/or re-wetting.

During the course of the FAO TCP/THA/3002 (A) Coffee project, trials were planned to seek ways to address these issues of storage to improve quality of coffee and avoid OTA contamination.

A coffee storage special was conducted at the Chumphon Horticulture Research Centre, in south Thailand where polyethylene bag liners designed to reduce re-absorption of moisture for rice in storage were trialed to evaluate the impact on coffee quality long term coffee storage. Four forms of coffee were stored for a period of 9 months from 14 March 2005 to 16 Dec 2005 in the 50 kg polyethylene bag liners. Four control samples of the same coffee were stored in 4 traditional woven polypropylene sacks.

Materials and methods

Dry coffee of 12% moisture was sourced from two previous experiments on processing and drying. (See reports in this same series on Wet Processing Methods and Drying. Methods for Robusta Coffee) Four forms of coffee were stored for a period of 9 months from 14 March 2005 to 16 December 2005 in the 50 kg polyethylene bag liners in a naturally ventilated coffee store. Four control samples of the same coffee were stored in 4 traditional woven polypropylene sacks.

The four forms of Coffee were sourced from the trial runs 2 and 3 of the coffee drying trials conducted at CHRC. (See other reports in this series on Coffee Processing and Coffee drying).

Dry cherry

Dry parchment

Dry split coffee

Green bean

Coffee in each of the 4 forms was divided. Approximately 10 kg were packed in a normal woven polypropylene sack (30 x 60 cm) and 50 kg was placed in special bag liner (75x130 cm) from IRRI (International Rice Research Institute in the Philippines).

The four forms of coffee stored in two types of bags (8 lots in total) were then placed on a normal wooden pallet in a well ventilated warehouse at Chumphon Horticultural Research Station coffee processing facility.

The following data were collected from each sack over the course of the trial.

- Moisture content of each sack was measured monthly by an Aqua Boy moisture meter..
- Water Activity (Aw) of each sack was measured monthly by a Hygropalm Hygrometer.
- Samples for mycological analysis were taken from each sack monthly from month 6 of the trial until the end of the trial and analysed at CHRC mycological laboratory.
- Temperature and relative humidity were continuously measured in the warehouse by a thermo-hydrograph.
- A Data logger was placed in four of the sacks (2 x green bean and 2 x dry cherry) to log temperature and relative humidity.
- At the end of the trial samples were be taken for cup quality testing by the CHRC coffee lab and Nestle Thailand
- OTA was determined using the standard international HPLC procedures.

Results and discussion

Moisture in stored coffee

Continuous monitoring of the conditions in the storage facility was accomplished with a recording thermo-hygrometer and the conditions in the storage sacks were monitored by periodic sampling. The uniformity of the Thai climate ensures that there are only small variations in the storage environment. The average daily relative humidity (RH) was generally between 70 and 80% with a diurnal fluctuation between ±10 to 20%RH. Coffee in equilibrium with this atmosphere would be expected to approach a M.C. of about 17% (wb) and a proportion of batches would be expected to support slow mould growth and OTA production when these conditions prevail.

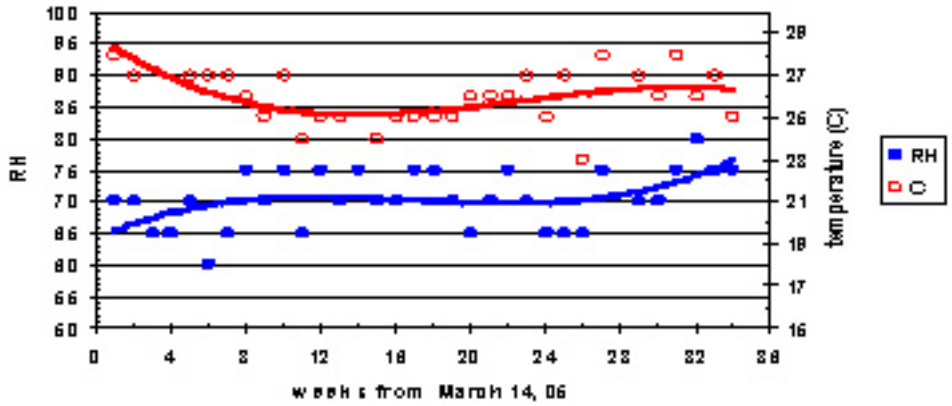

Figure 1. Storage conditions in the CHRC store during the storage trial

The coffee forms might be expected to differ in their storability based on the fact that they contain different amounts of husk and the fact that husk and bean differ with respect to water binding. Likewise, the different storage systems, woven polypropylene

sacks and hermetically sealed polyethylene sacks might also be anticipated to differ.

From the beginning of storage, there was further drying during the three months of the dry season as seen in Table 1, followed by significant water uptake in five of the eight storage/coffee combinations. This uptake proceeded at about 0.01 Aw units per month over the wet season where moisture was taken up. Except for parchment, the coffee forms responded similarly in the two kinds of bags: Cherry, either whole or split, gained water and finished with the highest Aw ranging from 0.72 to 0.75; green bean did not take up moisture.

Parchment stored in polypropylene sacks did not increase in Aw but the same material in IRRI bags did. The final Aw of the parchment in IRRI bags was still drier than the driest of the cherry coffee lots at an Aw of 0.70 despite the increase which was probably due to moisture in the coffee mass.

Table 1. Change in the AW of stored coffee

Bag type	**Change in AW**		**Final Aw**	**Final M.C.**
	MAR to MAY	**MAR to NOV**		**(oven wb)**
IRRI bag				
Cherry	0	0.05	0.72	12.2
Split Cherry	0	0.05	0.72	12.1
Parchment	-0.1	0.05	0.70	12.5
Green Bean	-0.06	-0.04	0.68	11.8
PP sack				
Cherry	-0.01	0.06	0.75	13.5
Split Cherry	-0.02	0.07	0.72	12.5
Parchment	-0.04	0	0.71	13.6
Green Bean	0	0	0.71	12.6

The first tabulated period corresponds to the dry season which runs from February through May. Changes in M.C. are very small and probably insignificant with respect to coffee quality and OTA.

Fungal activity during storage

There were no significant changes in the bean-infecting fungi over the nine months of this study. There were five samplings during the storage period. All samples showed infection by *Aspergillus niger* complex at rates between 80 and 100%. *Penicillium* was routinely detected and did not appear to change in frequency. There was considerable variation in the rates of occurrence of the rarer fungi but no indication that any had changed during the storage period. No species of the ochre *Aspergillus* group were detected, nor was any OTA detected in any treatment. Clearly there is no indication in this test that storage in normal ambient Thai conditions over nine months leads to any problems caused by fungi, if correctly dried coffee at 12% moisture content is placed on pallets in a ventilated store.

Table 2. Cup quality evaluation of stored coffee

Coffee source	Cup quality comments	
IRRI bag		
1. Split cherry	Clean, soft, normal	
2. Green bean (from dry cherry)	Clean, soft, normal	
3. Dry parchment	Clean, soft, normal	
4. Dry cherry	Clean, softer harsh, typical	
PP bag		
5. Split cherry	Clean, soft, normal	
6. Green bean (from dry cherry)	Clean, soft, normal	
7. Dry parchment	Clean, soft, normal	
8. Dry cherry	Clean, softer, harsh, typical	
9. Control: new season coffee	Clean, harsh, medicinal, "Robusta aroma"	

Cup Quality evaluation of 8 samples stored in 4 bag liners and 4 normal sacks over a 9 month period was carried out by a cupping team at the cupping laboratory of the CHRC. A standard "new season" coffee (sample 9) was included for comparison. No "off" flavours were found in 8 samples, indicating that both storage bags for the 4 forms of coffee were acceptable. Samples 4 and 8 were found to have the typical harsh medicinal flavour associated with fresh Robusta. Samples 4 and 8 were similar in cup quality to the control sample of new season Robusta. The results indicate that storage in the form of dry cherry tends to preserve the harsh Robusta original flavour of cherry dried coffee more than the other three forms of coffee storage.