4.2 Effect of storage times on rice quality of ‘Suphan Buri 1’

Suphan Buri 1’ paddy and milled rice kept in PE (Polyethylene) bags were stored at ambient temperature ($30\pm2^{o}C$) for 6 months. Their quality changes were measured and compared with the initial value.

4.2.1 Moisture content of paddy (%)

The moisture content of paddy did not change during storage and it was 8.30–8.80% (Table 4.2.1).

4.2.2 Colour of paddy (value)

L*, a*, b* and h° values the colour of paddy are shown in Table 4.2.1 The L* and a* values were significantly decreased after 4 months compared to initial sample and gradually reduced thereafter 6 months. On the other hand, the b* and h° values significantly increased at the 4^{th} month and slightly increased after storage for 6 months.

Table 4.2.1 Effect of storage times on MC% (w.b.) and colour of' (L*, a*, b* and h^o values) of 'Suphan Buri 1' during storage.

Storage times (months)	MC (w.b.) (%)	Colour of paddy (value)			
		L*	a*	b*	h°
0	8.80	58.48 ab	5.74 a	27.04 b	78.01 b
2	8.57	59.10 a	6.09 a	27.77 b	77.61 b
4	8.30	55.89 bc	5.17 ab	31.72 a	80.62 a
6	8.66	53.38 c	4.38 b	32.38 a	81.39 a
F-test	ns	**	*	**	**
C.V.	3.70	3.30	12.74	5.61	1.91

The different means in columns separated by small letters indicate statistical significance according to the Duncan's New Multiply Range Test (*P≤0.05*). The absence of letter indicates statistical non-significance: ns = no significance, * = statistically significant at *P*≤0.05 and ** = statistically significant at *P*≤0.01.

4.2.3 Colour of brown rice (value)

The change of brown rice colour revealed the same tend of the paddy but its change was 2 month late. The L* value of brown rice significantly decreased after 4 months and slightly decreased after 6 months (Table 4.2.2). Similarly, the a* value gradually reduced during storage. After storage for 4 months, the a* value was significantly lower than the initial value and the value at 2th month of storage. The significantly highest b* value in the brown rice was observed after 6 months. The b* value was slightly changed during storage for 2 and 4 months. The h^o value presented the same tend as b* value, which was the highest after 6 months (table 4.2.2).

Table 4.2.2 Effect of storage times on L*, a*, b* and h^o values of 'Suphan Buri1' brown rice during storage.

Storage times (months)	Colour of brown rice (value)			
	L*	a*	b*	h°
0	64.39ab	2.67 a	17.25 b	81.18 c
2	65.58 a	2.38 a	17.58 ab	82.28 b
4	62.38 b	1.90 b	17.78 ab	81.90 bc
6	60.01 c	1.17 c	18.34 a	85.63 a
F-test	**	**	ns	**
C.V.	2.09	10.88	3.00	0.66

The different means in columns separated by small letters indicate statistical significance according to the Duncan's New Multiply Range Test ($P \leq 0.05$). The absence of letter indicates statistical non-significance: ns = no significance and ** = statistically significant at $P \leq 0.01$.

4.2.4 Determination to detect of grains of brown rice from stored paddy

1) Head yield of brown rice (%)

Storage for 2 months significantly increased head yield of brown rice compared to the initial value, thereafter it not change (Table 4.2.3).

2) Chalky grains (%)

The percentage of chalky grains was 10.28–13.92% during 4 months. It was significantly decreased by storage for 6 months (Table 4.2.3).

3) Cracked grains (%)

The cracking of brown rice slightly increased after 4 months compared to the initial and 2 months of storage values. However, cracking of the brown rice was below 1.0%.

4) Defect grains (%)

The defect grains of brown rice significantly decreased after 2 months and it gradually declined to be 0.68% after 6 months.

Table 4.2.3 Effect of storage times on head yield of whole grains and imperfect grains of 'Suphan Buri 1' brown rice during storage.

Storage time (months)	Head yield of brown rice (%)	Imperfect grains (%)		
		Chalky (%)	Cracked (%)	Defect grains (%)
0	46.71 b	10.28 b	0.24 b	1.98 a
2	51.33 a	13.92 a	0.22 b	1.25 b
4	54.59 a	10.45 b	0.46 a	1.14 b
6	51.81 a	5.29 c	0.57 a	0.68 c
F-test	**	**	**	**
C.V.	4.45	15.98	22.03	17.84

The different means in columns separated by small letters indicate statistical significance according to the Duncan's New Multiply Range Test ($P \leq 0.05$), ** = statistically significant at $P \leq 0.01$.

4.2.5 Colour of milled rice from stored paddy (value)

The colour (L*, a*, b* and h^o values) of milled rice or white rice were presented in Table 4.2.4. The significantly declined of L* value was found after 2 months and it gradually declined during storage for 6 months. Similarly, the a* value gradually reduced during storage. The significantly difference of a* value was found after 4^{th} and 6^{th} month-storage compared to the initial value.

The b* value of milled rice increased after storage and it significantly increased after 4 months and the greatest value was 9.85 at the 6^{th} month storage.

The h^o value was 86.97–88.27 during storage for 4 months but it significantly went up to be 94.63 after storage for 6 months.

Table 4.2.4 Effect of storage times on L*, a*, b* and h^o values of 'Suphan Buri 1' milled rice from stored paddy during storage.

Storage times (months)	Colour of brown rice (value)			
	L*	a*	b*	h°
0	70.84 a	0.40 a	8.67 c	88.27 b
2	66.47 b	0.38 a	8.99 bc	86.97 c
4	62.79 c	0.25 b	9.46 ab	87.89 b
6	59.96 c	0.22 b	9.85 a	94.63 a
F-test	**	**	*	**
C.V.	3.06	11.60	5.13	0.62

The different means in columns separated by small letters indicate statistical significance according to the 'Duncan's New Multiply Range Test' (*P‹0.05*). * = statistically significant at *P*‹0.05 and ** = statistically significant at *P*‹0.01.

4.2.6 Determination to detect milled rice grains from stored paddy

1) Head yield of milled rice (%)

Even though the whole grain of milled rice from stored paddy significantly reduced after storage for 2 months, the head yield gradually increased to 40.25% at the 6^{th}-month, closed to the initial value (Table 4.2.5).

2) Imperfect grains of milled rice (%)

A. Chalky grains (%)

The initial value of chalky rice was 6.39% and went down to 1.35% after 6 months. The chalkiness of milled rice significantly decreased after 2 months.

B. Cracked grains (%)

The cracking of milled rice slightly was increased by storage the paddy for 6 months and it was lower than 0.5%.

Table 4.2.5 Effect of storage time on the head yield of whole grains and imperfect grains of 'Suphan Buri 1' milled rice from stored paddy during storage.

Storage time (months)	Head yield of milled rice (%)	Imperfect grains	
		Chalky (%)	Cracked (%)
0	42.39 a	6.39 a	0.13 b
2	30.50 c	5.12 a	0.13 b
4	39.21 b	2.87 b	0.28 a
6	40.25 ab	1.35 c	0.25 a
F-test	**	**	**
C.V.	4.62	21.43	33.74

The different mean in columns separated by small letters indicate statistical significance according to the 'Duncan's New Multiply Range Test' ($P<0.05$), ** = statistically significant at $P<0.01$.

4.2.7 Colour of stored milled rice (value)

The L* and a* values of milled rice began to decreased after 2 months. Their values were 71.41 and 0.32 for L* and a* after storage for 6 months, however, they were not significant different compared to the initial sample. The longer storage increased b* value of milled rice and significantly different from the initial value after storage for 4 and 6 months. The h° of milled rice increased from 88.27 to be 89.72 after 6 months.

Table 4.2.6 Effect of storage times on L*, a*, b*, and h° values of ‘Suphan Buri 1’ milled rice storage.

Storage times (months)	Colour of brown rice (value)			
	L*	a*	b*	h°
0	73.34	0.40 a	8.67 c	88.27 a
2	72.94	0.36 a	9.03bc	87.97 b
4	72.42	0.36 a	9.54 b	88.11a
6	71.41	0.32 a	11.04 a	89.72b
F-test	ns	ns	**	**
C.V.	1.65	17.64	4.20	0.74

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test’ ($P<0.05$).The absence of letters indicates statistical non-significance: ns = no significance, ** = statistically significant at $P<0.01$

4.2.8 Determination to detect from stored milled rice

1) Head yield of milled rice

The yield of milled went up after storage and it significantly increased when storage for 4 months. Storage for 6 months did not significantly increase head yield compared to the storage time for 4 months (Table 4.2.7).

A. Chalky grains (%)

The chalky percentage of milled rice significantly decreased after 2 months and at the end of the research (6 months), the chalky grains reduced from 6.39 to 1.40% (Table 4.2.7).

B. Cracked grains (%)

The cracking of milled rice increased 2-fold after 4 months but it did not change after storage for 6 months (Table 4.2.7).

Table 4.2.7 Effect of storage times on the head rice yield of whole grains and imperfect grains of 'Suphan Buri 1' stored milled rice during storage.

Storage time (months)	Head yield of stored milled rice (%)	Imperfect grains (%)	
		Chalky (%)	Cracked (%)
0	42.39 b	6.39 a	0.13 b
2	44.35 b	3.33 b	0.16 b
4	48.44 a	2.35 c	0.37 a
6	48.90 a	1.40 d	0.32 a
F-test	**	**	**
C.V.	4.31	17.71	20.61

The different means in columns separated by small letters indicate statistical significance according to the 'Duncan's New Multiply Range Test' ($P<0.05$). ** = statistically significant at $P<0.01$.

4.2.9 Amylose content (%)

The initial amylose content of milled rice was 28.87% after storage as paddy or milled rice the amylose content increased to be 32.42 and 32.30% after 6 months (Table 4.2.8).

Table 4.2.8 Effect of storage times on the amylose content of 'Suphan Buri 1' milled rice from stored paddy and stored milled rice during storage.

Storage time (months)	Amylose content (%) of milled rice	
	Stored paddy	Stored milled rice
0	28.87 b	28.87 b
2	31.20 a	29.95 b
4	31.35 a	31.75 a
6	32.42 a	32.30 a
F-test	**	**
C.V.	4.34	3.74

The different means in columns separated by small letters indicate statistical significance according to the 'Duncan's New Multiply Range Test' ($P<0.05$). ** = statistically significant at $P<0.01$.

4.2.10 Elongation ratio (mm)

The elongation of cooked rice was 1.31 and the increase of storage period increased the elongation ratio. The elongation ratio changed to be 13.9 and 1.40 for milled rice from stored paddy and stored mill rice after storage for 6 months, respectively (4.2.9).

Table 4.2.9 Effect of storage times on the elongation of milled rice from stored paddy and milled rice during storage.

Storage time (months)	Elongation ratio (mm) of milled rice	
	stored paddy	stored milled rice
0	1.31 b	1.31
2	1.31 b	1.32
4	1.33 ab	1.39
6	1.39 a	1.40
F-test	ns	ns
C.V.	3.18	4.45

The different means in columns separated by small letters indicate statistical significance according to the 'Duncan's New Multiply Range Test' ($P<0.05$). The absence of letters indicates statistical non-significance: ns = no significance.

4.2.11 Water absorption (%)

The water absorption of milled rice after cooking gradually increased and significantly difference from the initial value when the paddy or milled rice were stored for 2 months (Table 4.2.10).

Table 4.2.10 Effect of storage times on the water absorption of ‘Suphan Buri 1’cooked of milled rice from stored paddy and stored milled rice during storage.

Storage time (months)	Water absorption (%)	
	Milled rice from stored paddy	Milled rice stored
0	121.71 c	121.71 c
2	141.50 b	138.58 b
4	147.25 ab	145.66 a
6	156.16 a	145.91 a
F-test	**	**
C.V.	5.83	3.18

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test ($P<0.05$). ** = statistically significant at $P<0.01$.

4.2.12 Texture of cooked rice hardness and stickiness (N)

The texture of cooked rice, presented as hardness and stickiness, is presented in Table 4.2.11 The hardness of cooked rice from stored paddy significantly increased after for 6 months where as the hardness of the stored milled rice significantly increased at the 4^{th} month. The stickiness of cooked rice gradually reduced during storage for both type of rice.

Table 4.2.11 Texture of cooked rice (hardness and stickiness) of ‘Suphan Buri 1’cooked milled rice from stored paddy and milled rice during storage.

Storage time (months)	The texture of cooked rice (N)			
	stored paddy		stored milled rice	
	Hardness	Stickiness	Hardness	Stickiness
0	36.28 b	-1.85 a	36.28 b	- 1.85 a
2	36.47 b	-1.77 a	33.17 b	- 1.48 a
4	36.66 b	-1.58 a	40.90 a	-1.43 a
6	44.87 a	-1.33 a	43.77 a	-1.29 a
F-test	**	ns	**	ns
C.V.	30.16	27.30	5.98	27.33

The different means in columns separated by small letters indicate statistical significance according to the ‘Duncan’s New Multiply Range Test’ ($P<0.05$). The absence of letters indicates statistical non-significance: ns = no significant, ** = statistically significant at $P<0.01$.