

## *Asian Journal of Food and Agro-Industry*

ISSN 1906-3040

Available online at [www.ajofai.info](http://www.ajofai.info)

### **Quality of Local Upland Rice Seeds produced under Organic Farming System**

**\*Raumjit Nokkoul and Teerayut Wichitparp**

King Mongkut's Institute of Technology Ladkrabang, Chumphorn Campus, Pathio, Chumphorn, 86160, Thailand

\* Author to whom correspondence should be addressed, email: [knraumji@kmitl.ac.th](mailto:knraumji@kmitl.ac.th);  
[r\\_nokkoul@yahoo.com](mailto:r_nokkoul@yahoo.com)

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#### **Abstract**

Local upland rice varieties: Pukaotong, Nangchuan, Lebnok, Dokkam, Kawdam, Nangkruan and Samduen were produced using organic farming system at the experimental plots of King Mongkut Institute of Technology Ladkrabang, Chumphorn Campus during June-October 2008. The seeds were of high quality. The average rate of germination was 90.7% with 23.2 g. per 1,000 seed weight and 14.0% seed moisture content. The speed of germination index was between 8.2-12.7; seedling dry weight from 3.4 to 5.1 mg/seedling; root length between 6.1-8.9 cm/seedling; shoot length between 4.0-4.7 cm/seedling and conductivity from 3.73 to 12.01  $\mu\text{mho/cm/gm}$ .

#### **Keywords:**

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#### **Introduction**

Thailand has 1.6 million rai of upland area for rice-growing. The rice grown here is nurtured with natural rain water (Chongkid, 2005). Besides the environment, there are many other factors to consider in upland rice growing and one is the quality of the seeds which is an indicator for their growth rate, consistency and final outcome (Santipracha, *et al.*, 1992), especially in organic farming system which does not make use of fertilizers, pesticides, and synthetic growth controller (Lampkin, N.H. and Padel, S. 1994). The use of high quality seeds enhances the production efficiency under the organic farming system, reducing the risks,

making it possible to accurately calculate the amount to grow, and the seedlings are healthy with consistent and quick growth rate. Hence, to study the quality of the paddy produced via upland organic farming is crucial in helping to supply the organic rice farming system with good quality seeds.

## Materials and Methods

Seven varieties of upland rice: Pukaotong, Nangchuan, Lebnok, Dokkam, Kawdam, Nangkruan and Samduen were grown in seven 10x10 meters plots with 5 meter distance between each. 500 kg. of organic fertilizer was well-mixed into each rai. The planting was done by using pointed stick to make holes 25 cm. apart in rows with the distance of 30 cm. in between. Four seeds were put in each hole but after the seeds germinated, only three seedlings were kept in each hole. Weeds were eliminated by using hoes twice at the age of 20 and 40 days after the planting. Harvesting was done when all the seeds turn yellow, using small traditional cutters to collect the ears of paddy. The humidity of the produce was reduced; healthy and shriveled seeds were separated and the good seeds were tested for their quality. Seed quality was tested according to the rules of International Seed Testing Association (1993) and the Association of Official Seed Analysis (2002). Each test was done with four replications.

## Results and Discussion

### Seed yield

The flowering age at 50% (Table 1) of Pukaotong variety was at the highest number of days (108 days) which was not significantly different from those of Lebnok, Dokkam, and Nangchuan varieties (106, 106, 105 days respectively). However, it was significantly different from those of Nangkruan, Kawdam, and Samduen varieties which were 98, 103 and 86 days respectively. Pukaotong, Lebnok, Dokkam and Nangchuan varieties had similar harvesting ages of between 132-133 days but had statistically different ones with those of Nangkruan and Samduen varieties (124 and 115 days respectively). Samduen variety gave the highest yield of 728 kg./rai (Table 1) which was statistically different from those of Pukaotong, Nangkruan, Lebnok, Dokkam, Kawdam and Nangchuan (307, 519, 311, 500, 307 and 403 kg./rai respectively).

### Seed quality

Seed sizes (Table 1) of the 7 varieties were measured in length and width. It was found that Nangkruan, Kawdam, and Samduen varieties had non-statistically different width ranging in between 2.58-2.59 mm. However, the widths were significantly different from those of Pukaotong, , Lebnok, Dokkam, and Nangchuan varieties of which the seed widths were 2.32, 2.17, 2.20, and 2.32 mm. respectively. As for the weight of 1,000 seeds, Nangkruan variety yielded the highest weight which was statistically different from those of Pukaotong, Lebnok, Dokkam, Kawdam, Nangchuan and Samduen varieties (22.98 24.14 22.15 23.06 22.13 and 23.30 gm. respectively). KDML 105 or its mutant lines. Yoshihashi et al. (2004) has reported that 2AP content of KDML105 depends on area of cultivation. Higher 2AP content is detected in KDML105 rice grains produced in rain-fed paddy fields in Tungkula ronghai region, drought and salinity area, more than that of other regions in the Northeastern Thailand.

**Table 1.** Flowering age at 50%, harvesting age of the seeds, no. of harvested plants yield, Seed size, and 1,000 seed weight of local upland rice seed produced under organic farming system.

varieties	flowering age at 50% days)	harvesting age of the seeds (days)	Seed yield (kg/rai)	Seed size (mm)		1,000 seed weight (gm)
				Width	Length	
Pukaotong	108a	133 a	307 d	2.32 b	10.02 a	22.98 c
Nangchuan	98c	124 b	519 b	2.58 a	8.47 e	24.53 a
Lebnok	106ab	133 a	311 d	2.17 c	8.71 d	24.14 b
Dokkam	106ab	132 a	500 b	2.20 c	9.57 b	22.15 d
Kawdam	103b	131 a	307 d	2.59 a	8.96 c	23.06 c
Nangkruan	105ab	132 a	403 c	2.32 b	8.51 e	22.13 d
Samduen	86d	115 c	728 a	2.58 a	8.47 e	23.30 c
Mean	117	128	439	2.39	8.95	23.20
F-test	*	*	*	*	*	*
C.V.(%)	2.83	1.99	11.16	1.82	1.59	0.1

\* Means not followed by the same letter are significantly different at the 5% level of probability as determined by DMRT.

All the seeds of the seven varieties produced under the organic farming system had a standard average rate of germination of 90.70% (Table 2) with Nangchuan variety achieving the highest rate of 94.50%, which was not significantly different from Pukaotong, Nangkruan and Dokkam varieties with the germination rates of 93.00, 92.50, 90.50% respectively, but was significantly different from Lebnok, Kawdam, and Samduen varieties with the standard germination rate of 88.50, 86.00 and 89.00% respectively. As for the germination in the soil, Samduen variety had the highest rate of 85.50%, not significantly different from Lebnok, Nangchuan and Dokkam varieties with the rate of 85.00, 82.50 and 85.50% respectively, but significantly different from Pukaotong, Nangkruan and Kawdam varieties with the rate of 77.0, 82.00, 72.50% respectively.

All varieties started germinating at day 4 but with different number of normal seedlings, resulting in statistically different germination rate index. Kawdam variety had the highest rate of 8.16, statistically different from Pukaotong, Nangkruan, Lebnok, Dokkam, Nangchuan and Samduen with the germination rate index of 9.86, 10.38, 11.73, 10.90, 10.27 and 12.70 respectively.

**Table 2.** Standard germination ,Soil emergence, Speed of germination and Seedling dry weight of local upland rice seed produced under organic farming system.

varieties	Standard germination (%)	Soil emergence (%)	Speed of germination index	Seedling dry weight (mg/seedling)
Pukaotong	93.00ab	77.00c	9.86c	3.90bc
Nangchuan	92.50ab	82.00b	10.38c	4.47ab
Lebnok	88.50b	85.00ab	11.73ab	4.77ab
Dokkam	90.50ab	82.50ab	10.90bc	3.43c
Kawdam	86.00c	72.50d	8.16d	4.17abc
Nangkruan	94.50a	85.00ab	10.27c	4.75ab
Samduen	89.00b	85.50a	12.70a	5.12a
Mean	90.70	87.35	10.57	4.37
F-test	*	*	*	*
C.V.(%)	3.29	2.56	7.15	13.39

\* Means not followed by the same letter are significantly different at the 5% level of probability as determined by DMRT.

The seedling dry weight (Table 2) of Samduen variety was the highest at 5.12 mg./seedling, not statistically different from Nangkruan, Lebnok, Dokkam and Nangchuan varieties which yielded the seedling dry weight of 4.47, 4.77, 4.17, and 4.75 mg/ seedling respectively, but statistically different from those of Pukaotong and Dokkam (3.90 and 3.43 mg/seedling respectively). The root lengths (Table 3) of Lebnok, Dokkam and Nangchuan varieties were the longest ranging between 8.50-8.90 cm.seedling, statistically different from those of Pukaotong, Nangkruan, Kawdam, and Samduen (6.05, 7.69, 7.64, and 6.97 cm. respectively).

Samduen variety had the longest shoot length of 4.71 cm./seedling, not statistically different from those of Nangkruan, Dokkam, Kawdam, Nangchuan and Samduen (4.30, 4.41, 4.56, 4.25 and 4.71 cm./seedling respectively) (Table 3) but statistically different from those of Pukaotong, and Lebnok (4.02 and 4.03 cm./seedling respectively). As for conductivity, Pukaotong variety the highest at 12.10  $\mu\text{mho/cm/gm}$ , statistically different from those of Nangkruan, Lebnok, Dokkam, Kawdam and Nangchuan varieties (6.23, 3.73, 5.19, 6.42, 6.55 and 6.15  $\mu\text{mho/cm/gm}$  respectively).

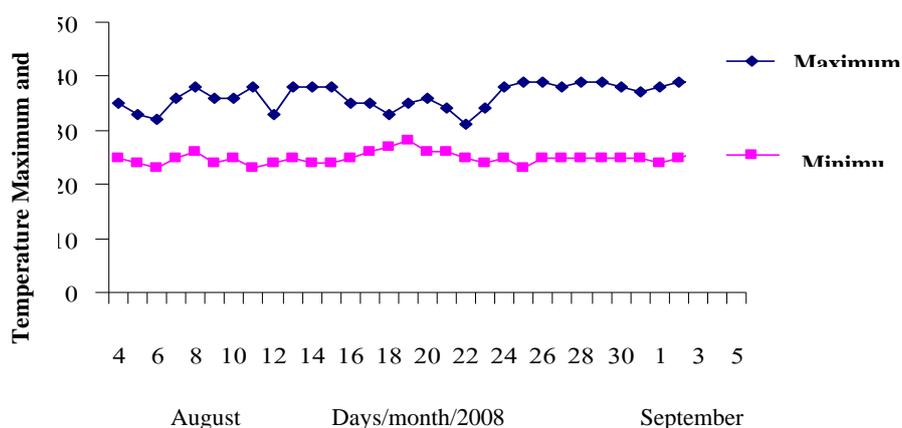
**Table 3.** Root length, Shoot length and Conductivity of local upland rice seed produced under organic farming system.

varieties	Root lentgth (cm/seedling)	Shoot lentgth (cm/seedling)	Conductivity ( $\mu\text{mho/cm/gm}$ )
Pukaotong	6.05c	4.02b	12.10a
Nangchuan	7.69b	4.30ab	6.23bc
Lebnok	8.90a	4.03b	3.73d
Dokkam	8.50a	4.41ab	5.19c
Kawdam	7.64b	4.56ab	6.42bc
Nangkruan	8.65a	4.25ab	6.55b
Samduen	6.97b	4.71a	6.15bc
Mean	7.77	4.32	4.89
F-test	*	ns	*
C.V.(%)	6.89	8.38	12.54

ns = non – significant

Means not followed by the same letter are significantly different at the 5% level of probability as determined by DMRT.

The study of rice seed quality of the seven varieties: Pukaotong, Nangchuan, Lebnok, Dokkam, Kawdam, Nangkruan, and Samduen produced under the organic farming system yielded 307, 518, 311, 500, 307, 403 and 728 kg./rai respectively. The percentage of germination averaged at 90.70%, lower than those grown by using chemicals as reported by Nokkoul *et al.*, (2008). This was probably because of the severe draught at the time of sprouting, budding, flowering, and seed forming: there were more than 20 days without rain, with the temperature as high as 39°C (Figure 1). As is known, rice under high temperature during seed forming will yield shriveled seeds with high chance of being sterile, and low production. If during the flowering stage, rice is exposed to the temperature of 34°C and 38°C for 4 hours and 41°C for 2 hours, the healthiness of the seeds will drop to only 15% (Chongkid, 2005).

**Figure 1** Highest and lowest temperatures during August-September 2008 in the rice plots grown under organic farming system

**Source:** Measurement at the plots (2008)

## Conclusion

The production of rice seeds under organic farming system using organic fertilizers (cow dung) of 500 kg./rai enabled all varieties to yield high quality seeds. This showed that the production using organic farming system was an appropriate method of production which could be used to produce agricultural products to satisfy the needs of the consumers who want to consume safe food. Thailand as an agricultural country, especially is advantageous in many aspects since it can use organic farming system as an alternative way, to add more value to the agricultural produce and food produced in the country. At the same time, this will help enable the Government's Food Safety Program to achieve its goals more effectively, resulting in the better life quality of the farmers, society and eventually better natural environment.

## Acknowledgement

This research study was successfully completed. The researcher would like to express her deepest gratitude towards Assoc. Prof. Dr. Kwanjit Santipracha, her supervisor.

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