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Research article

QUALITY OF UPLAND RICE SEED PRODUCED DURING THE RAINY SEASON IN SOUTHERN THAILAND

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ABSTRACT: The seed quality of five upland rice varieties: Samduen, Lebnok, Pukaotong, Nangkruan and Nangdam produced during the rainy season were done at the experimental plots of the King Mongkut's Institute of Technology Ladkrabang, Chumphon Campus, Thailand during July and November, 2010. The study was conducted in randomized complete block design with four replications. The results showed that upland rice seed quality, Samduen, Lebnok, Pukaotong and Nangdam varieties had 1,000 seed weight ranged from 20.62 to 21.62 g which were not significantly different among the varieties, but the four varieties were significantly different from Nangkruan variety of 19.00 g. All varieties had seed germination ranged from 89.50 to 91.75.00%. Samduen, Pukaotong and Nangdam had soil emergence ranged from 84 to 86% which were significantly different from the Lebnok and Nangkruan varieties of 71% and 74%, respectively. Nangdam variety had high speed of germination index of 9.86 which was statistically different from Samduen, Lebnok, Pukaotong and Nangkruan varieties of 3.43, 2.24, 3.26 and 6.74 respectively. All varieties had seedling dry weight ranged from 3.50 to 4.26 mg/seedling.
Keywords: seed quality, upland rice, southern Thailand

INTRODUCTION

Ninety percent of the world's rice is produced and consumed in Asia. In Thailand, most upland rice is grown in northern and southern, where it represents about 10.00% of total rice area. It has been grown almost exclusively by small-household food security. For the southern part of Thailand is the lowland and less area than other sectors, and can not produce enough rice for domestic consumption. Upland rice is planted as alternative crops of farmers for household consumption or for sale in local market. However, one of the major problems of upland rice in southern Thailand is seed yield and quality. Because of a drought that causing lack of rain, specifically during the rainy season when the rainfall is less than 1 mm per day with more than 15 consecutive days. Drought during the rainy season is incidentally caused by climate change, which would seriously affect growth and yield of upland rice [1]. These environmental factors are the principal reason that seed production of upland rice in southern Thailand. Thus, the objective of this study was to investigate the quality of upland rice seed produced in Chumphon province of southern Thailand.

MATERIALS AND METHODS

This study was conducted at King Mongkut's Institute of Technology Ladkrabang, Chumphon Campus, Thailand (Latitude 10º 00' 30.05" N Longitude 99º 25' 45" E Altitude 17.84 m above the sea level) from July to November, 2010. Five varieties of upland rice: Samduen, Lebnok, Pukaotong, Nangkruan and Nangdam seeds were produced during the rainy season. The land was ploughed and disc harrowed and leveled before sowing the seeds. Four seeds of upland rice were sown per hole with spacing of 25 cm. within rows and 30 cm. between rows. The plants were thinned to three plants per hole after 14 days of seedling emergency. The total area of each plot was 10 m^2. The fertilized 15N-15P-15K was applied twice, at 25 and 45 days after the seeds germinated. Weeds were eliminated by using hoes twice at the age of 20 and 40 days after the seeds germinated. Harvesting was done when all the seeds maturity. The data collected were flowering age at 50%, harvesting age of the seeds, seeds yield. After threshing, the seeds were sun-day, sieved and weighted after the measurement of the moisture content. The seed yields were determined for corresponding weight of standard moisture of 10%.

The good seeds were tested for their quality; seed size, 1,000 seed weight, standard germination, soil emergence, speed of germination index, seedling dry weight, root length and shoot length [2,3]. Each test was done with four replications. Data of daily rainfall and daily minimum and maximum temperatures from July to November, 2010 were gathered from the Tha Ta Pao Agrometeorological Station, Muang Chumphon, Chumphon, Thailand. All data were analyzed using the analysis of variance and means separated by Duncan's multiple range test (DMRT) at the 5% level of significance.

RESULTS AND DISCUSSION

The environmental variables: Rainfall, number rainy days, minimum and maximum temperatures of local upland rice including Samduen, Lebnok, Pukaotong, Nangkruan and Nangdam seed produced during the rainy season were shown in the Fig. 1. The results showed that the rainfall during the July to November, 2010 was found to be deleterious for upland rice seed yield and quality (Fig. 1B and 1C). Rice plants received 12.40 to 97.10 mm of average monthly rainfall; vegetative, reproductive, and seed formation to ripening stage the five tested varieties got the rainfall of 59.00, 57.40 and 97.10 mm with 10, 7 and 12 days raining, respectively, 31.40 to 35.20^{o}C of average monthly temperature (Fig. 1A).

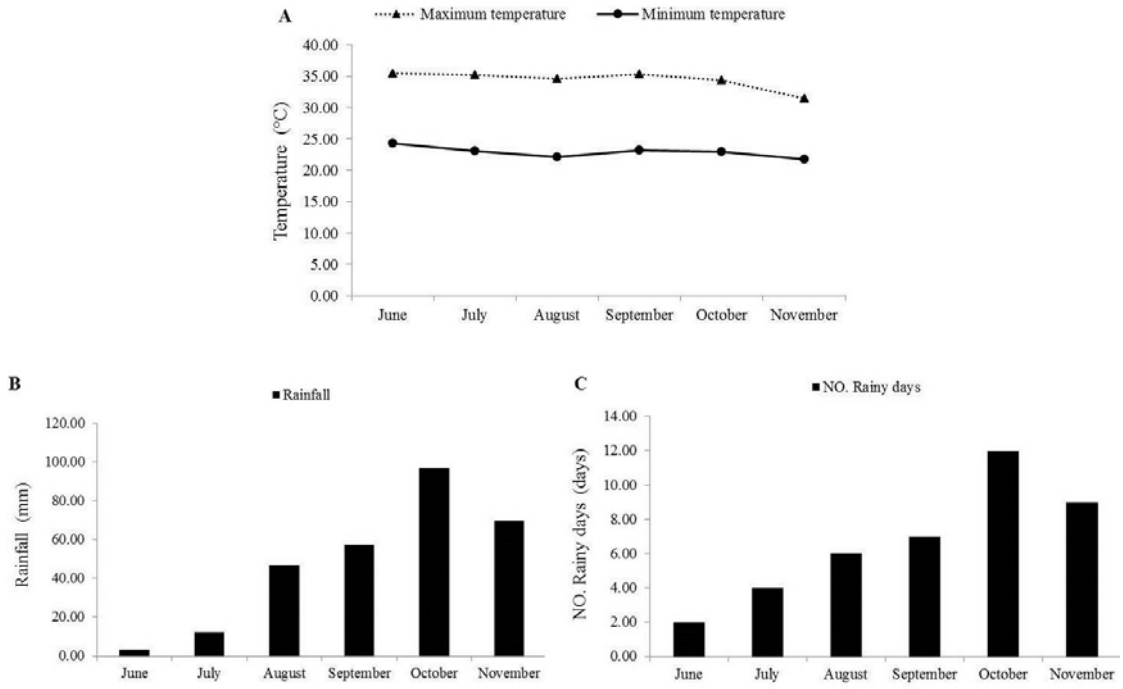

Fig. 1. Data of minimum and maximum temperatures (A), amount of monthly rainfall (B), and number of rainy days (C) in the experiment location, King Mongkut's Institute of Technology Ladkrabang, Chumphon Campus, Thailand during July to November 2010.

Seed Yield: The flowering age at 50% (Table 1) of Lebnok variety was at the highest number of days (96 days) which was significantly different from those of Samduen, Pukaotong, Nangkruan and Nangdam varieties of 78, 86, 91 and 93 days respectively. Lebnok and Nangdam varieties had similar harvesting ages of 123 and 122 days respectively, but had statistically different ones with those of Samduen, Pukaotong, and Nangkruan varieties of 106, 118 and 120 days respectively. Nangkruan variety gave the highest yield of 27.09 kg/ha (Table 1) which was not statistically different from those of Samduen, Lebnok, Pukaotong of 26.88, 23.58 and 23.52 kg/ha respectively), but had statistically different from the Nangdam variety of 18.86 kg/ha. However, the five upland rice varieties had lower seed yields when they were grown at the low level monthly rainfall of 12.40 to 97.10 mm in these periods. At the vegetative, reproductive, and seed formation to ripening stages the five tested varieties got the rainfall of 59.00, 57.40 and 97.10 mm with 10, 7 and 12 days raining, respectively, average monthly temperature of 31.40 to 35.20^{o}C (Fig.1A). These effects could reduce the seed yield. If total rainfall during vegetative and early reproductive stages was less than 610.00 mm, seeds yield averaged low [4].The reduction in yield of up to 30.00% was due to reduced panicle number per unit area in one trial, and reduced number of spikelet per panicle in another [5].

Table 1. Flowering age at 50%, harvesting age of the seeds, seed yield and 1, 000 seed weight of upland rice seed produced during the rainy season in southern Thailand

Varieties	Flowering age at 50% (days)	Harvesting age of the seeds (days)	Seed yield (kg/ha)	1,000 seed weight (g)
Samduen	77.00 d	106.00 d	26.88 a	20.62 ab
Lebnok	96.00 a	123.00 a	23.58 a	20.75 ab
Pukaotong	86.00 c	118.00 c	23.52 a	21.25 a
Nangkruan	91.00 b	120.00 b	27.09 a	19.00 b
Nangdam	93.00 b	122.00 a	18.86 b	21.62 a
F-test	*	*	*	*
CV (%)	1.82	0.95	9.80	5.75

Within each column, means not followed by the same letter are significantly different at the 5% level of probability as determined by DMRT; * = significant different

Seed quality: Samduen, Lebnok, Pukaotong and Nangdam varieties had 1,000 seed weights ranged from 20.62 to 21.62 g which were significantly different from Nangkruan variety of 19.00 g (Table 1). Seed sizes (Table 2) of the five varieties were measured in width and length ranged from 0.21 to 0.25 and 0.85 to 1.01 cm, respectively. It was found that Samduen, Lebnok, Pukaotong, Nangkruan and Nangdam varieties were significantly different among the varieties. However, the thick were not significantly different among the varieties of 0.18 to 0.21 cm, respectively. All varieties had high seed germination ranged from 89.50 to 91.75%. Samduen and Pukaotong had high soil emergence of 86% which were not significantly different from the Nangdam variety which gave the soil emergence of 84%, but had statistically different from Lebnok and Nangkruan varieties of 71% and 74%, respectively.

Table 2. Seed size, standard germination and soil emergence of upland rice seed produced during the rainy season in southern Thailand

Varieties	Seed size(cm.)			Standard germination (%)	Soil emergence (%)
	width	length	thickness		
Samduen	0.25 a	0.85 d	0.19	90.00	86.00 a
Lebnok	0.21 b	1.01 a	0.18	89.50	71.00 c
Pukaotong	0.21 b	0.98 ab	0.19	90.50	86.00 a
Nangkruan	0.23 a	0.93 bc	0.18	89.50	74.00 b
Nangdam	0.25 a	0.88 cd	0.21	91.75	84.00 a
F-test	*	*	ns	ns	*
CV (%)	4.89	3.99	13.37	4.00	1.82

Within each column, means not followed by the same letter are significantly different at the 5% level of probability as determined by DMRT; ns = non-significant;
*** = significant different**

Nangdam variety had high speed of germination index of 9.86, statistically different from Samduen, Lebnok, Pukaotong and Nangkruan varieties of 3.43, 2.24, 3.26 and 6.74 respectively. All varieties had seedling dry weight ranged from 3.50 to 4.26 mg/seedling which were not significantly different among the varieties. Samduen variety had the longest root length of 11.58 cm/seedling, not statistically different from Pukaotong, Nangkruan and Nangdam varieties of 9.76, 10.27 and 9.39 cm/seedling, respectively, but had statistically different from Lebnok variety of 7.45 cm/seedling. Samduen variety had the longest shoot length of 11.49 cm/seedling, not statistically different from Nangkruan and Nangdam of 10.03 and 11.32 cm/seedling, respectively, but had significantly different from Lebnok and Pukaotong varieties of 8.35 and 8.33 cm/seedling, respectively (Table 3). This study of upland rice seed quality of the five varieties: Samduen, Lebnok, Pukaotong, Nangkruan and Nangdam produced during the rainy season had small seed, the 1,000 seed weight averaged at 20.64 g. The percentage of germination averaged at 90.25%, speed of germination index averaged at 5.09 and seedling dry weight averaged at 3.98 mg/seedling, lower than those grown by using chemicals and organic farming system as reported by Nokkoul and Wijitparp [6].

These were probably due to the severe draught at vegetative, reproductive and seed formation to ripening stage that had no rainfall more than 20 days with the temperature as high as 35°C. In addition, environment conditions during crop growth and development can strongly impact subsequent seeds yield, germination ability, and vigor. While environmental stresses, such as temperature and moisture extremes, are known to reduce seed viability and vigor, whereas the physiological causes of seed quality loss are unclear [7].

Table 3. Speed of germination index, seedling dry weight, root length and shoot length of upland rice seed produced during the rainy season in southern Thailand

varieties	Speed of germination index	Seedling dry weight (mg/seedling)	Root length (cm/seedling)	Shoot length (cm/seedling)
Samduen	3.43c	4.11	11.58a	11.49a
Lebnok	2.24d	4.26	7.45b	8.35b
Pukaotong	3.26c	3.90	9.76ab	8.45b
Nangkruan	6.74b	3.50	10.27ab	10.03ab
Nangdam	9.86a	4.17	9.39ab	11.32a
F-test	*	ns	*	*
CV (%)	5.01	16.60	20.87	18.03

Within each column, means not followed by the same letter are significantly different at the 5% level of probability as determined by DMRT; ns = non-significant;
*** = significant different**

CONCLUSION

Seed quality of upland rice produced during the rainy season in southern Thailand. The results show that rainfall is the important limiting factor for local upland rice cultivation. Five upland rice varieties: Samduen, Lebnok, Pukaotong, Nangkruan and Nangdam had lower seeds yield and quality when they were grown at the low level rainfall. However it is clear that the long-term productivity of upland rice in Thailand can not be sustained. Improved crop and resource management technologies are necessary for sustainable production.

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