

Research Article

Organic Upland Rice Seed Production

Raumjit Nokkoul

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

Abstract: The upland rice is popular for growing in southern Thailand because this area is the lowland and less area than other sectors. Upland rice is grown as alternative crops of farmers for household consumption which using organic farming method because organic rice seed can be produced by self-production in farmhouse. However, the upland rice is grown under organic farming system. The seeds must originate from plants being grown in compliance with the organic farming rules for at least one generation. There are many factors involving the production of seeds under organic farming system, making the yield low. Thus, the objective of this study on appropriate methods of upland rice seed production under organic farming system in southern Thailand. The results showed that in producing organic seeds, suitable varieties should be selected to suit each area with regular high yield quality. It can be grown in low fertile soil, resist pests and diseases and compete with weeds. The suitable season should be selected for the seed production and the growing areas ought to be in an ecological zone with at least 14-20 mm of 5-day rainfall during the growing cycle. Soil fertility: crop rotation, green manure plants, compost of rice straw and organic manures. For control of disease and insect pests use of resistant or tolerant varieties, plant extracts, natural enemies. The organic seed production of upland rice in southern Thailand, Samduen variety had suitability for recommendation to seed producer in this area because it can provide high growth, yield and seed quality.

Keywords: Organic farming system, organic seed, southern thailand, upland rice

INTRODUCTION

Organic farming is one of several approaches to sustain agriculture production. It has potential as a niche market for out of season produce, excluding the use of synthetic fertilizers, pesticides, growth regulators and transgenic seeds. Organic producers rely heavily on crop rotations, crop residues, animal manures, legumes, green manures, organic wastes and mineral-bearing rocks to fertilize the soil and supply plant nutrients. Insects, weeds and other pests are managed by mechanical cultivation and cultural, biological and bioregional controls (Lampkin and Padel, 1994). In Thailand, organic agriculture has become a major policy for agricultural development. The main objective is to reduce the use of agro-chemicals in conventional farms, but very few concrete projects have been implemented. However, organic farming is not a recent phenomenon in Thailand since local farmers have practiced traditional farming for hundreds of years. Such practices have been developed and enriched through farmers' knowledge of local agro-ecology and environmentally sustainable ways of farming (Chinsathit, 2012). Organic rice production in southern Thailand is grown upland rice (Nokkoul and Wijitparp, 2009). The rice grown here is nurtured with natural rain water (Nokkoul and Wijitparp, 2013a). Besides the

environment, there are many other factors to consider in upland rice growing and one is the quality of the seeds which are an indicator for their growth rate, consistency and final outcome (Santipracha *et al.*, 1992). Especially, in organic farming system which does not use fertilizers, pesticides and synthetic growth controller (Lampkin and Padel, 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. Therefore, the study on quality of upland rice seed (which is produced by organic farming) is crucial in helping to supply the organic rice farming system with good seed quality.

Legislation of use of seed in organic farming in Thailand: Seed and plant propagation come from organic agriculture. In case seed and plant propagation can't be from organic agriculture, using of conventional seed is allowed but chemical treatment is prohibited. Exception can be made when organic farming is in the early stage of development or there is an unexpected accident; therefore, chemical traded seed and plant propagation may be used. But by the year 2014, producers shall develop seed production and plant propagation within the farm or exchange them with

other organic producers (Organic Agriculture Certification Thailand (A.C.T.), 2012).

The main problems in organic upland rice seed production: Water availability is an important factor in upland rice seed production. Since upland rice is totally depends on rainfall, effective water management is very important in improving nutrient use efficiencies. Nutrient availability is positively related to soil moisture. If water deficiency prolonged, nutrient availability reduced and yield is adversely affected. However, yield reduction depends on growth stages at which water stress occurred and duration of stress (Fageria, 2001). The rainfall is one of the important limiting factors for upland rice seed production. During growth stages, the plants which received less rainfall, not appropriated distribution of rainfall and no rainfall for 20 days continuously, these would seriously cause decreasing growth rate. These effects could reduce the plant height, seed yield and quality (Nokkoul and Wichitparp, 2013a). These effects could reduce the seed yield. In vegetative and early reproductive stages, upland rice was seed yield averaged low was due to the reduction of panicle number per unit area in one trial, reduction number of spikelet per panicle and the seed yield (Nokkoul and Wichitparp, 2013b; Nokkoul *et al.*, 2011). Phenology is important in determining grain yield response also because quick maturing cultivars often escape from severe stress, while late maturing cultivars may be affected by a terminal stress.

MATERIALS AND METHODS

Land selection: The good farming practices are especially important when growing upland rice for seed production. Proper selection of land is critical to ensure maximum quality and economic yield. Select area in an ecological zone with at least 14-20 mm of 5-day rainfall during the growing cycle. Choose fertile land with good drainage and good water retention capacity (Oikeh *et al.*, 2011).

Soil fertility: The specific nutrient management of organic seed production of upland rice, animal manure is cattle manure rate of 3,125 kg/ha (Nokkoul and Wichitparp, 2013a). Application of non-aging manure is prohibited, except when the manure is treated with heat and should be in dry condition (Organic Agriculture Certification Thailand (A.C.T.), 2012).

Seed treatment: Seed preparation starts with washing and sorting dirt and immature grain then seeds are soaked in water for 2 h. After that soaked seeds are packed into bag to incubate the seeds about 12 h at temperature of 30°C (Nokkoul and Wijitparp, 2013a).

Growing time: The upland rice is grown in southern Thailand, the seeds which are grown in late May to early July when the rains are well established and the soil is moisture. If possible, seeds of upland rice should be immediately grown after a good rainfall (Nokkoul and Wijitparp, 2009).

Seed rate: It is advisable to use organic seeds which have good quality from a reliable source for growing. If the seed producer plans to use their own seeds, it is important to first sort out unfilled seeds before growing in order to enhance good germination. Therefore, upland rice growing should use proportion of seeds per area about 12-13 kg/ha (Nokkoul and Wijitparp, 2009).

Growing methods: Select seven varieties of upland rice: Samduen, Pukaotong, Lebnok, Nangkruan, Nangchuan, Nangdam and Dokkam seeds were produced via organic farming system at the experimental plots of King Mongkut's Institute of Technology Ladkrabang, Prince Chumphorn Campus, Thailand (KMITL PCC) during June to October, 2008. The land was ploughed and disc harrowed and leveled before growing the seeds. The fertilizer was applied at the rate of 3,125 kg/ha of cattle manure (mixing into the soil before growing). The 4 seeds of upland rice were grown per hole with spacing of 25×30 or 30×30 cm. The plants were thinned to 3 plants/hole after 14 days of seedling emergency. Seed production plots should be isolated from crops of the same variety. The minimum isolation distance from neighboring crops of other varieties is 10 m. Weeds were eliminated by using hoes twice at the age of 20 and 40 days after the seeds germinated (Nokkoul and Wijitparp, 2009). For pest and disease control were reported by researcher that have application in Table 1 and 2.

Rouging: Rouging is the removal of off-types or mixtures. Rouging in a seed production plot is extremely important as pollen from off-type plants can cause irreparable damage through cross-pollination. Rouging should be made continuously. Usually, in vegetative growth, flowering, post flowering and pre-harvest times. Off-types can be identified by the following characteristics of plants; height, growth cycle, grain color, grain shape, panicle shape, leaf shape, leaf base color and awn (Oikeh *et al.*, 2011).

Harvesting: The upland rice is ready for harvest when the seeds are turning yellow/brown. That is about 28-30 days after flowering or a month after 50% flowering (seed maturity). Cut the panicle (above flag leaf) and drying before threshing.

Drying: Dry seeds (sun-dry of 2-3 days) by spreading in a thin layer (2-3 cm thick) on tarpaulins and turning over periodically. Upland rice seed should be dried to

Table 1: Organic methods for disease control

Test disease	Disease control	Citations
Blast disease	Resistant/tolerant varieties <i>Bacillus megaterium</i> Fungicides Silica	Oikeh <i>et al.</i> (2011) Kanjnamaneesathian <i>et al.</i> (2009) Ghazanfar <i>et al.</i> (2009) Rodriguesa <i>et al.</i> (2003) and Seebold <i>et al.</i> (2004)
Brown leaf spot	Plant extracts (<i>Pometia pinnata</i>) (leaf)	Plodpai <i>et al.</i> (2013)
Sheath blight, leaf and neck blast disease	<i>Bacillus megaterium</i> Neem oil at 3% Silica	Kanjnamaneesathian <i>et al.</i> (2009) Lokanadhan <i>et al.</i> (2012) Rodriguesa <i>et al.</i> (2003) and Seebold <i>et al.</i> (2004)
Sheath rot	Plant extracts (<i>Aegle marmelos</i>) (fruit)	Plodpai <i>et al.</i> (2013)
Dirty panicle disease	Chitosan	Boonreung and Boonlertmirun (2013)
Black kernel	Plant extracts (<i>Dewos chinensis</i>) (leaf)	Plodpai <i>et al.</i> (2013)

Table 2: Organic methods for pest control

Test insects	Insect control	Citations
Rice bug	Intoxicating yam, nami, wild yam (head)	Oikeh <i>et al.</i> (2011)
Brown planthopper	Neem seed kernel extract 5% Natural enemies (predators)	Lokanadhan <i>et al.</i> (2012) Chanu <i>et al.</i> (2010)
Stem borers	Use of resistant/tolerant upland rice varieties, natural enemies (predators) and strip- and inter-cropping Intercrops	Oikeh <i>et al.</i> (2011) Epidi <i>et al.</i> (2008)
Bird	Install bird nets if available	Oikeh <i>et al.</i> (2011)
Rodent	Use of local metal traps	Oikeh <i>et al.</i> (2011)

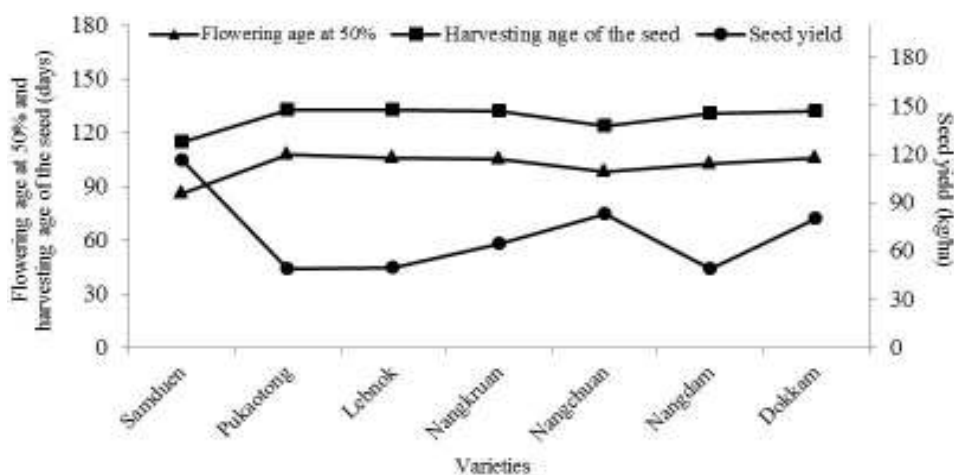


Fig. 1: Flowering age at 50%, harvesting age of the seed and seed yield of upland rice seed produced under organic farming system (Nokkoul and Wijitparp, 2009)

less than 10% moisture as soon as possible after threshing and preferably placed in a sealed container.

Testing for vigor of seed: 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, shoot length and AA-test (AOSA, 2002).

RESULTS AND DISCUSSION

The upland rice seed production under organic farming system in southern Thailand. The results showed that the upland rice growing under organic farming system recommended that Samduen variety

had the potential because it had short harvesting age and can provide better growth and yield than other varieties (Fig. 1). All varieties of upland rice had high seed quality when growing under organic farming system (Fig. 2). In addition, the organic upland rice seeds could be stored under room temperature for 9 months without losing their germ-inability. However, Nokkoul and Wijitparp (2009), Nokkoul (2011) and Nokkoul *et al.* (2011) reported that the upland rice grown under organic farming system in southern Thailand. It had high growth, seed yield and quality; alternative management organic farming system is selected upland rice varieties which can adapt to the best local environment. They have the ability to growth in low fertile soil, to resistant on pests and diseases and to compete with weeds and good practice (Fig. 3).

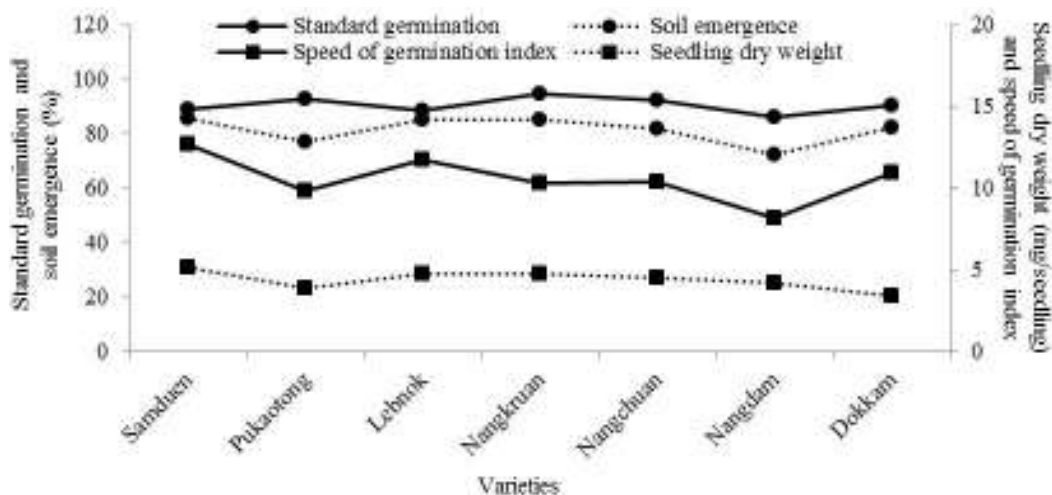


Fig. 2: Standard germination, soil emergence, speed of germination and seedling dry weight of upland rice seed produced under organic farming system (Nokkoul *et al.*, 2011)

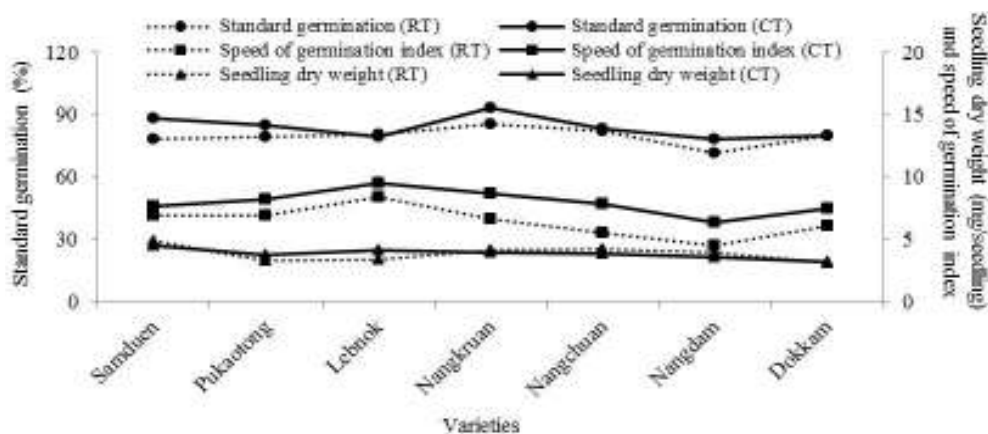


Fig. 3: Quality of organic upland rice seed stored at Room Temperature (RT) and Cold Temperature (10°C) (CT) at 9 months (Nokkoul, 2011)

CONCLUSION

The organic seed production of upland rice in southern Thailand, Samduen variety had suitability for recommendation to seed producer in this area because it can provide high growth, seed yield and quality when using cattle manure rate of 3,125 kg/ha. However, the production of upland rice seeds under organic farming method needs more meticulous care and attention in tending to the plants all through the growing season than the use of chemical. Seed producers need to have knowledge, experience and understanding about the production under organic farming method.

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