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Smallholder farmer seed production of Mulato II hybrid brachiaria in Thailand and Laos - bringing quality forage seeds home to Africa

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Key words: Tropical grass seed production; brachiaria; seed harvesting; seed quality

Abstract

Seeds of Mulato II hybrid brachiaria [*Urochloa ruziziensis* (syn. *Brachiaria ruziziensis*) x *U. brizantha* (syn. *B. brizantha*) x *U. decumbens* (syn. *B. decumbens*)] produced by smallholder farmers in villages in northeast Thailand and northern Laos, under contract to Ubon Forage Seeds Co. Ltd, a tropical forage seed company in Thailand, have come home to Africa. Since 2012, over 20,000 kg of Mulato II seed have been exported from Thailand to Kenya. The seed is hand-harvested from seed-heads in Laos and by hand-sweeping the seed from the ground in Thailand. The farmers semi-clean the seed in the field and then further winnow the seed back at their houses in cane trays or through small motorized seed cleaners. Ubon Forage Seeds Co. Ltd purchases the seed and then treats the seed with sulphuric acid to improve seed germination from below 10% to above 80%. Since 2008, 300,000 kg of Mulato II seed have been produced by the smallholder farmers and exported to over 20 countries. The pathway of smallholder farmers producing Mulato II seeds in Thailand and Laos and then exporting this seed to Kenya and other countries in Africa to be used by smallholder farmers to improve livestock production, is discussed.

Introduction

Mulato II hybrid brachiaria [*Urochloa ruziziensis* (syn. *Brachiaria ruziziensis*) x *U. brizantha* (syn. *B. brizantha*) x *U. decumbens* (syn. *B. decumbens*)] was introduced into Thailand in 2003 by Tropical Seeds LLC, a USA forage seed company (Hare et al. 2013; Hare 2014). Mulato II is a three way cross but it is not a F1 hybrid. Tropical Seeds LLC, contracted Ubon Forage Seeds Co. Ltd at Ubon Ratchathani University to conduct research on Mulato II seed production and management. The decision was then made to produce Mulato II seed by smallholder village farmers who had a long history of producing a range of tropical forage seeds since the early 1970s (Hare 1993).

Thailand is a major rice producing country and the skills of producing rice seeds, are used to produce high quality tropical forage seeds. Tropical forage seeds are in high demand in Thailand to plant pastures for over 7,000,000 head of ruminant animals (Waipanya and Poathong 2018). Demand for Thailand-produced forage seeds has created an export market to other tropical countries in Asia and Africa.

Because of Mulato II's high forage quality, drought tolerance and persistence, demand for its seed has rapidly increased. Since 2008, 300,000 kgs of Mulato II have been produced by the small-holder farmers. In 2012, Tropical Seeds LLC started exporting Mulato II seeds to Kenya and to date, over 20,000 kg of Thailand-produced Mulato II seeds have been imported into Kenya from Thailand.

This paper will discuss the methodology of producing Mulato II seeds in Thailand and Laos and outline ways in which Kenya could also produce her own Mulato II seeds.

Mulato II seed research in Thailand

Mulato II seed yields have always been less than half the seed yields of ruzi grass [*Urochloa ruziziensis* (syn. *Brachiaria ruziziensis*)] in Thailand (Kowithayakorn and Phaikaew 1999; Hare et al. 2007a) and those of signal grass [*U. decumbens* (*B. decumbens*)] and Marandu palisade grass [(*U. brizantha* (syn. *B. brizantha*)] in Brazil (Souza 1999). Even though Mulato II flowers profusely, by seed harvest there is a large failure of seed set (Miles and Hare 2007), with nearly 90% of the spikelets producing non-viable seed (Hare et al. 2013). A series of field experiments from 2004 to 2013, were conducted by Ubon Forage Seeds to try and increase seed yields through agronomic management. Field trials were conducted on time of planting (Hare et al. 2007a), closing date (Hare et al. 2007b) and methods of seed harvesting (Hare et al. 2007c). Through this research, seed yields have increased from 250 kg/ha to over 600 kg/ha.

Mulato II seed crops planted early in the wet season produced significantly more seed than crops planted late in the wet season (Hare et al. 2007a). However, with early-sown crops, a closing date cut two months before flowering (cutting to between 5 and 10 cm above ground level) must be imposed or severe lodging can occur before flowering (Hare et al. 2007b). If the cut is one month before flowering, seed yields

will be severely reduced. Tying nylon bags over the Mulato II seed heads at anthesis will yield twice as much seed as other methods of seed harvesting (Hare et al. 2007c).

Seed storage trials were also conducted (Hare et al. 2008; Hare et al. 2018). Within one year of storage in an ordinary room under ambient conditions in Thailand (mean monthly temperatures 23-34°C; mean monthly relative humidity 80-96%), all Mulato II seeds were dead. Storing the seed in our cool-room (18-20°C and 50% relative humidity) enabled Mulato II seed to maintain seed germination above 50% for 4-5 years (Hare et al. 2018). Currently, all our Mulato II seeds are stored in our cool-room after processing and bagging.

Farmer Mulato II seed production

Thailand seed production

Mulato II seeds are produced in Nong Saeng village, Roi-et province (16° N; 130 masl) in Thailand. The farmers in Nong Saeng village used to produce ruzi grass seed for many years and they applied the same management practices to produce Mulato II seed. At the beginning of each wet season, each farmer receives 1-4 kg of Mulato II seed to plant a nursery. Planting a nursery is how the farmers establish their rice fields. The farmers transplant 4- to 6- week-old seedlings into well-cultivated fields in June and July. The fields must be free of weeds and debris, because at harvest the Mulato II seeds are swept from the ground. The seedlings are planted in rows 80-90 cm apart and at spacings of 50-60 cm within the rows. Compound fertilisers (NPK) are applied in August and September at a rate of about 200 kg/ha. Different formulations of the NPK fertilisers are used depending on farmer experience. No herbicides or insecticides are used on the seed crops.

For seed harvesting, the farmers allow the seed to fall to the ground. They abandoned harvesting seeds from the seed heads, because the time of harvesting, November, coincided with rice harvesting, which taxed the labour force on the farm (Hare 2014). After the rice harvest, the farmers cut all the vegetation to ground in late December-January and remove it from the seed field. Seed on the ground is swept up, along with sand, soil, leaves and other litter. The seed is firstly cleaned in the field through screens to remove the bulk of the debris and then back at their houses winnowed in cane trays or cleaned through small motorized seed cleaners provided free by Ubon Forage Seeds Co. Ltd.

The fields are left fallow through the dry season and replanted in the wet season, though Mulato II is not always planted in the same field. The Mulato II seed crop fields are replanted each year because the seed yields in second and subsequent years in Thailand, even with fertiliser, are very low on the poor soils.

Laos seed production

Mulato II seeds are produced in Laos in several villages in Nga district, Oudomxay province (23° N; 500 masl). For the first year the farmers receive seed to plant a nursery. In Laos, the fields are on very steep hill slopes and so are not cultivated for fear of erosion. The 4- to 6- week old seedlings are directly planted into small holes dug with a hoe in closely cut vegetation. The holes are spaced at 1.1.25 m between rows and 60-70 cm within rows.

During the growing season, farmers cut the local grasses and weeds between the Mulato II plants. No fertiliser, herbicides or insecticides are applied to the Mulato II seed crops in Laos. In September, the leaves and stems of each plant are tied together to make an upright bunch, and in late October, the process of tying the stems is repeated just before anthesis to make living sheaves (Kowithayakorn and Phaikaew 1993). The seed is gently knocked into cane trays or baskets every 1-2 days, dried slowly in the shade for 1-2 weeks and then sun-dried for 4-5 days before cleaning and winnowing using cane trays. The seed is dried again prior to sale to reach 10% seed moisture.

The Lao farmers maintain the seed fields for up to 10 years (Hare 2014). In the second-year and older seed crops, the Mulato II plants are cut for forage during the dry season or cut to provide mulch around the Mulato II plants and to prevent weeds from growing. In the wet season a final closing cut to ground level is conducted in July. Many Lao farmers, without using fertiliser, have produced consistently good seed yields (250-280 kg/ha) for many years (Hare 2014). Mulato II is providing a sustainable and environmentally friendly perennial crop in Laos by preventing erosion and controlling weeds.

Mulato II seed processing

The Lao-produced seed is purchased from the farmers in early January and trucked through Laos, across the Mekong River and down to Ubon Forage Seeds Co. Ltd seed warehouse in Ubon Ratchathani, a distance of

1,500 km. In March, the Thai-produced seeds are purchased and trucked to Ubon Forage Co. Ltd, a distance of 200 km.

At the seed warehouse, the Mulato II seeds are treated with sulphuric acid by rotating the seeds and acid in a concrete mixer. The seeds are then washed in lime and water to neutralise the acid, washed again in troughs and under high pressure hoses and then sundried on a concrete pad. 700 kg can be processed in one day by acid scarifying in the morning and drying in the afternoon. Acid scarification removes the lemma and palea husks which are tightly bound and impose a strong physical dormancy (Hare et al. 2008).

After sun drying down to moisture levels of between 8-10%, the seeds are cleaned again and then stored in Ubon Forage Seeds Co. Ltd cool room (18-20°C and 50% RH). After acid scarification, Mulato II seeds average 70-90% germination and over 99.5% purity. We never get above 90% germination. Without acid scarification, the seeds only average 10-30% germination. Length of storage in a cool room will still not break the physical dormancy (Hare et al. 2008).

Can Kenya produce Mulato II seed?

I believe that Kenya, can indeed produce her own Mulato II seed. This is because Africa is the “home” to the three species that make up the three-way cross of Mulato II; ruzi grass, palisade grass and signal grass. These three species flower in their natural habitat. Also, Kenya does have a history of producing tropical forage seeds. Seed of Rhodes grass (*Chloris gayana*), *Setaria* (*Setaria sphacelata* var. *anceps*) and some guinea grass cultivars [(*Megathyrsus maximus* (syn. *Panicum maximum*)] are produced in Kenya (Bogdan 1977; Boonman 1971). If these grasses can successfully produce seed in Kenya, then why not seed of Mulato II?

When I first came to Thailand in 1974, there was no seed production of any of the improved tropical grasses, At that time, improved pastures were made with cuttings of para grass [*Urochloa mutica* (syn. *Brachiaria mutica*)] and common napier grass (*Pennisetum purpureum*). Both did not persist on the poor soils and long dry seasons. Since then, for over forty years in Thailand there has been a successful government supported forage seed production programme producing a wide range of forage seeds on government stations and in villages (Hare 1993; Hare and Phaikaew 1999, Hare and Horne 2004). Tropical forage seed production has been integrated into village cropping systems in northeast Thailand and has become the main commercial crop for many smallholder farmers (Hare and Horne 2004).

These are the steps Kenya should take to try and establish successful Mulato II seed production

1 Field research on applied seed production agronomic management. Mulato II will not produce good seed yields anywhere. Sites with a favourable climate and favourable soils must be found. For ground sweeping the seed, fine fibrous soils are the most suitable.

2 The researchers must have a specialist seed scientist champion who will lead the research.

3 Once suitable sites have been selected, then pilot project feasibility studies must be under taken.

4 There must be selection and training of farmers in seed crop management, harvesting and cleaning.

5 Technical support must be provided to the seed growers.

6 A company or government institution must contract to buy the seed at a guaranteed price.

7 There must be good processing and storage of the Mulato II seeds.

8 The market for Mulato II seed in Kenya has already been established.

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