

Invited Review

Development of Tropical Pasture Seed Production in Northeast Thailand - Two Decades of Progress

M.D. Hare¹

ABSTRACT

Tropical pasture seed production in Northeast Thailand has evolved through research, pilot projects and a government supported seed enterprise. An increase in beef and dairy production led to a large demand for pasture seed which has been supplied through a government seed enterprise, based on production by village farmers and from government stations. Seed production by village farmers resulted from research and pilot projects with Townsville stylo (*Stylosanthes humilis*), which led to large scale village farmer seed production of Verano stylo (*S. hamata*) and Ruzi grass (*Brachiaria ruziziensis*). Over 950 tonnes of tropical pasture seed are now annually hand harvested in Northeast Thailand, 70% by village farmers.

Additional index words: *Stylosanthes humilis*, *S. hamata*, *Brachiaria ruziziensis*, hand harvesting, village farmers.

INTRODUCTION

Up until the early 1970s very little attention had been given to pasture seed production in Northeast Thailand and improved pastures were generally planted vegetatively with cuttings of *Brachiaria mutica* (Forsk.) Stapf. and *Panicum maximum* Jacq. (Hare and Waranyuwat, 1980). However, the climate, geography and socio-economic aspects of the region are conducive to pasture seed development (Wickham, Shelton, Hare and de Boer, 1977; Hare, 1980; Manidool, 1991; Phaikaew, Manidool and Devahuti, 1993). Northeast Thailand is on a slightly elevated plateau of 17 million hectares, 100 to 300 m above sea level and between latitudes 14° and 19° N. Most agricultural land is flat to gently rolling, with soils which are mostly sandy, acid and low in organic matter, plant nutrients (particularly nitrogen, phosphorus and sulphur) and water holding capacity (McLeod, 1972; Eyles, Shelton, Buranviriyakul and Saksri, 1973). These soils are easily cultivated by either tractor or water buffalo (Wickham *et al.*, 1977). The tropical savannah climate experienced by the region has proved very suitable for seed production of some tropical pasture species, especially *Stylosanthes* spp. (Wickham *et al.*, 1977). There is a pronounced seasonal rainfall with over 80% of the annual rainfall (approximately 1250 mm) falling from May to October. There are sufficient dry periods during this rainy season to harvest grass seed. From November to February there is a reliable cool dry season with shorter daylengths suitable for legume seed production (Hare and Waranyuwat, 1980). Furthermore, rice production in the wet season enables farmers to have time in the dry season to produce pasture seed and utilise underemployed labour. Pasture seed returns are also economically attractive compared to other upland crops (De Boer, Shelton and Wickham, 1976; Wickham *et al.*, 1977; Askwith, 1979).

This paper reviews two decades of progress of pasture seed production in Northeast Thailand from research and pilot projects to a large scale government supported seed enterprise.

RESEARCH AND PRODUCTION

Pasture development in Northeast Thailand using improved tropical species from The Division of Tropical Crops and Pastures, CSIRO, Australia began in the mid-1960s at the Borabu Land Development Centre with financial support from the New Zealand Government (McLeod, 1972; Hare, 1977). A range of species quickly established high producing pastures, especially *Stylosanthes humilis* H.B.K., *Cynodon dactylon* (L.) Pers., *Cenchrus ciliaris* L., *Panicum maximum*, *S. guianensis* (Aubl.) Sw. and *Macroptilium atropurpureum* (DC.) Urb. *S. humilis* was introduced to Thailand by Mr Boonyaruk Suebsiri of the Land Development Department (McLeod, 1972; Humphreys, 1984) and in pasture trials, oversowing *S. humilis* had been demonstrated to be a culturally and economically feasible method of improving unproductive village pastures and increasing cattle production in Northeast Thailand (Crump, 1972; McLeod, 1972; Hare, 1974; Robertson, 1975). The subsequent demand by farmers for improved pastures for beef and dairy production led to research on seed production, as vegetative cuttings could not meet the demand. Furthermore, the most useful species at that time, *S. humilis*, could not be successfully planted by cuttings.

In 1972 and 1973 small areas of grass seed (*P. maximum* and *C. ciliaris*) and legume seed (*M. atropurpureum* and *S. humilis*) were hand harvested at Borabu. In 1974 it was decided to increase the scale of seed production to allow machine harvesting. For *S. humilis*, a

¹ AgResearch Grasslands, Private Bag 11008, Palmerston North, New Zealand. Accepted for publication 29 June 1993.

large rotating cylinder was designed by Mr Russell Coombe to harvest the seed and a steel strap cylinder to clean the seed by Mr Pichit Toolsook with assistance from Mr Gordon Wickham (Hare, 1977; Wickham *et al.*, 1977). Financial support came from the New Zealand Embassy in Bangkok. In 1974 and 1975, 3450 and 4800 kg of *S. humilis* were machine harvested respectively at Borabu.

During this period a cage with a rotating beater was built by Mr Pitchitsopon Toolsook to harvest *C. ciliaris*, *P. maximum* var. *trichoglume* and *Urochloa mosambicensis* (Hack.) Dandy at Borabu. Trials were conducted to compare machine and hand seed harvesting methods and with all grass species, hand harvesting gave higher yields (Hare, 1976).

An outbreak of anthracnose in late 1976 devastated the *S. humilis* fields at Borabu and no seed was harvested. A change in direction at Borabu in the late 1970s meant that cropping increased in importance and pasture seed production was wound down. However, Borabu had paved the way for improved pasture development and seed production, and without the pioneering role at this site, it is doubtful whether pasture and seed production would have proceeded as quickly as it did in Northeast Thailand.

During this period (1973 to 1976), pasture development research was also being conducted at nearby Khon Kaen University with support from Queensland University and the Australian Government (Robertson, Humphreys and Edwards, 1976). Robertson *et al.* (1976) had found that *S. humilis* could produce up to 1630 kg DM ha⁻¹. An experiment was established to investigate seed production and hand harvesting methods for *S. humilis* and in 1974 and 1975, 1850 kg ha⁻¹ and 1420 kg ha⁻¹ of seed respectively were produced from the best treatments (Wickham *et al.*, 1977).

PILOT PROJECTS

A *S. humilis* seed production pilot project with seven local village farmers was established in 1975. The main objective of this pilot project was to assess the economic viability of establishing a seed production industry in Northeast Thailand, based on small scale village farming units using labour intensive production and harvesting techniques (De Boer *et al.*, 1976; Wickham *et al.*, 1977). The Khon Kaen University Pasture Improvement Project, with support from Queensland University and the Australian Government, supplied fertiliser and seed, and purchased all seed produced of 95% purity or greater. The farmers prepared the land, sowed the seed, weeded, applied the fertiliser and harvested and cleaned the seed. From a total planted area of 4 ha, seven farmers harvested 1831 kg of clean seed in early 1976. Three of these farmers harvested between 1000 and 1250 kg ha⁻¹ of seed (De Boer *et al.*, 1976; Wickham *et al.*, 1977). The results of this pilot project showed that Northeast Thailand was well suited to the large scale production of *S. humilis* seed and that there was the

potential for a village seed industry to be established (Wickham *et al.*, 1977).

However, the impact of anthracnose in late 1976 prevented any further development of the *S. humilis* village seed project. Fortunately *S. hamata* cv. Verano had been imported from Australia in 1976 by the World Bank/Northeast Thailand Livestock Development Project administered by the Department of Livestock Development. Besides establishing well in village oversowing pasture projects, Verano stylo was found to have some resistance to anthracnose (Humphreys, 1978). A pilot project in 1977, financed by the New Zealand Embassy in Bangkok under the direction of the aforementioned Livestock Development Project, investigated the feasibility of Verano village seed production (Hare, 1980). Five farmers produced and sold 500 kg of seed in early 1978 (average yield was 790 kg ha⁻¹). The project was run along similar lines to the previous *S. humilis* pilot project with fertiliser, seed and seed cleaning screens being supplied to the farmers. The Livestock project purchased the seed for US\$1.20 kg⁻¹.

In 1979 further pilot projects were established by the Livestock project to investigate village seed production of *S. scabra* cv. Seca, *S. guianensis* cv. Endeavour, Schofield and Cook, *Macroptilium atropurpureum* cv. Siratro and *Macroptiloma uniflorum* cv. Leichhardt. These legumes were successfully harvested but due mainly to a low demand for their seed, expanded village seed production programmes did not develop (Hare, 1980).

Brachiaria ruziziensis (Ruzi grass) was the first grass to be evaluated in a pilot village seed production programme in 1986 by the Animal Nutrition Division of the Department of Livestock Development (Phaikaew and Pholsen, 1993; Phaikaew *et al.*, 1993). Excellent seed yields and demand by beef and dairy farmers for Ruzi grass seed enabled the pilot project to be expanded with support from government and involvement by the private sector.

GOVERNMENT SEED ENTERPRISE

The Department of Livestock Development's Division of Animal Nutrition has been responsible for the implementation of a government supported seed enterprise which has now been operating successfully for over 15 years. Until 1975 the Animal Nutrition Division had produced small quantities of mainly grass seed on its forage stations, in particular the Pakchong station.

In 1975 the Department of Livestock Development began the Northeast Thailand Livestock Development Project with financing from the World Bank. A village pasture improvement programme was to be an important part of this project with 26000 ha to be improved in three years. To implement the pasture programme, seed was to be produced locally with annual targets of 1000, 45000 and 60000 kg of seed in the first, second and third years respectively.

Seed production began in 1975 on the forage stations

with the emphasis on *S. humilis* which was to be the most important species used in the village pasture improvement projects. Another large rotating cylinder and several seed cleaning machines were designed by Mr Gordon Wickham and built by local staff (Hare, 1980; Hare, 1985). Two suction harvesters were also imported from Australia to harvest *S. humilis* seed on the forage stations. The outbreak of anthracnose in 1976 severely reduced seed yields of *S. humilis* and even though plantings of Verano stylo progressed quickly in 1977, production figures were well below target. Furthermore, the rotating cylinder and forage harvesting system were not suitable for harvesting Verano stylo seed, as the seed fell to the ground very quickly once mature. The suction harvesting, while producing good quality seed, was slow, expensive to operate and the large areas involved could not be completed before the next wet season began. The previously described village seed production pilot project produced Verano stylo seed cheaply (US\$1.20 kg⁻¹) and gave good returns to the village farmers (Askwith, 1979). The village farmer Verano stylo seed production programme was therefore expanded by the Northeast Livestock Development Project, which provided seed, fertiliser and cleaning screens and bought the seed produced by the village farmers. In 1981, 187 tonnes of Verano seed was produced by 1131 village farmers at an average yield of 910 kg ha⁻¹ (Hare, 1985). Production of Verano stylo seed is now very efficient, and combined with better cleaning methods (Kowithayakorn and Phaikaew, 1993), returns to farmers are nearly US1000 ha⁻¹. Demand for Verano stylo seed has fallen off in Thailand and annual production is now about 100 tonnes. The Department of Livestock Development still buys the seed for US\$1.20 kg⁻¹ and sells it for US\$2.00 kg⁻¹.

The Department of Livestock Development started to produce Ruzi grass seed on forage stations in 1982 (Phaikaew and Pholsen, 1993). The rapid expansion of beef and dairy production in Thailand increased market demand for Ruzi grass seed, and a village farmer seed production programme was started in 1986 to overcome the shortfall in seed production (Phaikaew *et al.*, 1993). In 1992, 630 tonnes of Ruzi grass seed was processed by the Department of Livestock Development, with 60% of this seed being produced by over 2700 village farmers (Phaikaew and Pholsen, 1993). Village farmers receive seed and fertiliser from the Department which then buys the seed for US\$2.00 kg⁻¹ after it is cleaned by the farmers. This seed is then sold to beef and dairy farmers for US\$2.50 kg⁻¹ and every year all the seed produced is sold (Phaikaew, pers. comm.).

Research has continued into ways of improving production efficiency of Ruzi grass seed harvesting and the 'living sheaves' technique, combined with using seed nets to collect the seed, has enabled farmers to obtain yields as high as 440 kg ha⁻¹ (Kowithayakorn and Phaikaew, 1993). Full seed production details of Ruzi grass on government stations and by village farmers are provided by Manidool

(1991), Phaikaew and Pholsen (1993), Phaikaew *et al.* (1993) and Kowithayakorn and Phaikaew (1993).

The seed enterprise of the Animal Nutrition Division of the Department of Livestock Development produced 950 tonnes of grass and legume seed in 1992 (Phaikaew and Pholsen, 1993). Of this, Ruzi grass accounted for 66% of the production, Verano stylo 22% and the balance between a range of species produced on forage stations including *Panicum maximum*, *Paspalum plicatulum*, *Sorghum bicolor*, *Seteria sphacelata*, *Leucaena leucocephala*, *Stylosanthes guianensis* and *Centrosema pubescens*.

Private farmers also produce Ruzi grass seed for direct sale to dairy and beef farmers. The amount of seed produced by private farmers is not known but as dairy and beef production continues to expand in Thailand, the demand for pasture seed increases each year.

CONCLUSION

Pasture seed produced in Northeast Thailand has followed the same patterns of development as outlined by Ferguson and Sauma (1993), in which the relationship between market forces and seed systems relevant to small farmers was described. Research conducted by the research institutions (Borabu and Khon Kaen University) in the early 1970s led to pilot projects and then to the government funded seed enterprise as market demand increased. At the present time, pasture seed research continues, but results are passed directly to the village farmers and forage stations (Phaikaew and Pholsen, 1993).

As market demands continue to increase, more private seed trading will hopefully develop, reducing the need for the government supported seed enterprise to play a major role. Village farmers in Northeast Thailand are now very professional in their approach to the production of pasture seed, and production at village level should continue to increase.

ACKNOWLEDGMENTS

Dr John E. Ferguson for the encouragement to write this review and Khun Chaisong Phaikaew, Khun Pimpaporn Pholsen, Dr Don Loch and Dr Trevor Gibson for their valuable comments on the manuscript.

REFERENCES

1. Askwith, J.E. 1979. Economic evaluation of village seed production in Northeast Thailand. Research paper No. 4 Department of Livestock Development, Tha Phra, Khon Kaen, Thailand. 5 pp.
2. Crump, D. 1972. The economics of beef production in Thailand. ASPAC extension bulletin, No. 24. Taipei. 39 pp.
3. De Boer, D.J., Shelton, H.M. and Wickham, B. 1976. Hand harvesting of Townsville stylo seed by village

- farmers. Khon Kaen University Pasture Improvement Project Annual Report 1976. Faculty of Agriculture, Khon Kaen University, Thailand, 115-127.
4. Eyles, G.O., Shelton, H.M., Buranviriyakul, S. and Suksri, A. 1973. Fertiliser studies on forage legumes in north-eastern Thailand. *Thai Journal of Agricultural Science* 6: 35-43.
 5. Ferguson, J.E. and Sauma, G. 1993. Towards more forage seeds for small farmers in Latin America. *Proceedings of the XVII International Grassland Congress*: (in press).
 6. Hare, M.D. 1974. A realistic approach to cattle management improvement in Northeast Thailand. Department of Land Development, Bangkok, Thailand. 16 pp.
 7. Hare, M.D. 1976. Management report. Borabu Land Development Centre, Department of Land Development, Bangkok, Thailand. 30 pp.
 8. Hare, M.D. 1977. Townsville stylo seed harvesting at Borabu Land Development Centre, Northeast Thailand. *Thai Journal of Agricultural Science* 10: 9-15.
 9. Hare, M.D. 1980. Tropical pasture seed production in Northeast Thailand - Final Report. Department of Livestock Development, Tha Phra, Khon Kaen, Thailand. 34 pp.
 10. Hare, M.D. 1985. Tropical pasture seed production for village farmers in South-east Asia. Grasslands Division, DSIR, Palmerston North, New Zealand. 44 pp.
 11. Hare, M.D. and Waranyuwat, A. 1980. A manual for tropical pasture seed production in Northeast Thailand. Department of Livestock Development, Tha Phra, Khon Kaen, Thailand. 60 pp.
 12. Humphreys, L.R. 1978. Pasture research in Thailand: an Australian role. *Journal of the Australian Institute of Agricultural Science* 44: 180-186.
 13. Humphreys, L.R. 1984. Global ventures in *Stylosanthes*. V. South East Asia. In: *The Biology and Agronomy of Stylosanthes* (ed. H.M. Stace and L.A. Edye), 529-533, Academic Press, Sydney.
 14. Kowithayakorn, L. and Phaikaew, C. 1993. Harvesting and processing techniques for tropical grass and legume seeds under small farm holders. *Proceedings of the XVII International Grassland Congress*: (in press).
 15. Manidool, C. 1991. Seed production for pasture development in Thailand. *International Herbage Seed Production Research Group Newsletter* 14: 10-14.
 16. McLeod, C.C. 1972. Field investigation report. Borabu pasture and range Development Centre. Department of Land Development, Bangkok, Thailand. 40 pp.
 17. Phaikaew, C. and Pholsen, P. 1993. Ruzi grass (*Brachiaria ruziziensis*) seed production and research in Thailand. Proceedings of the 3rd FAO Regional forage working group of SE Asia on strategies for suitable forage-based livestock production. Khon Kaen, Thailand. (In press).
 18. Phaikaew, C., Manidool, C. and Devahuti, P. 1993. Ruzi grass (*Brachiaria ruziziensis*) seed production in Northeast Thailand. *Proceedings of the XVII International Grassland Congress*: (in press).
 19. Robertson, A.D. 1975. A realistic approach to pasture improvement in Northeast Thailand. *Thai Journal of Agricultural Science* 8: 69-85.
 20. Robertson, A.D., Humphreys, L.R. and Edwards, D.G. 1976. Influence of cutting frequency and phosphorus supply on the production of *Stylosanthes humilis* and *Arundinaria pusilla* at Khon Kaen, Northeast Thailand. *Tropical Grasslands* 10: 33-39.
 21. Wickham, B. and Shelton, H.M. 1976. Townsville stylo dry matter and seed yield response to applied fertiliser. Khon Kaen University Pasture Improvement Project Annual Report 1976. Faculty of Agriculture, Khon Kaen University, Thailand. 111-114.
 22. Wickham, B., Shelton, H.M., Hare, M.D. and de Boer, A.J. 1977. Townsville stylo seed production in North-eastern Thailand. *Tropical Grasslands* 11: 177-187.