LESSON FROM THE PEST INFESTATION OF LEUCAENA

K.T.MacKAY[1] and JANET DURNO[2]
IDRC SINGAPORE CUSO-THAILAND

ABSTRACT

The multipurpose tree species Leucaena leucocephala has until recently been considered the wonder tree. It is nitrogen fixing, grows rapidly, is very useful for animal feed, green manure, firewood, shade for coffee and cocoa and prevents soil erosion when planted in contoured hedgerows. It has been planted extensively by governments, private plantations and small farmers in Asia and the Pacific and is being promoted for use in alley cropping in Africa. An insect pest Heteropsylla cubana has recently spread from Central America to the South Pacific and Asia as far as India. It has decimated leucaena causing death of trees, cattle and people and loss of livelihood and soil protection. No control has yet appeared but farmers have quickly moved to other species. Researchers and policy makers have been much slower to act. The lesson from the leucaena experience is that diversity is needed - not only of species but of approaches.

We in the western developed world seem to have a strong belief in simple solutions. This is best illustrated by a character who has become part of American mythology. His name is the Lone Ranger. He rides around the American West on his horse called Silver with his faithful American Indian companion Tonto defeating evil. The most important aid to his cause are his magic silver bullets that always protect him.

Unfortunately in agricultural development we also seem to share this belief in the simple solution - the magic bullet that will cure all problems. The early successes of the green revolution in Asia with "miracle rice" reinforced that belief. Recently in Asia we have seen the spread of another magic bullet - the nitrogen fixing tree, giant Leucaena or ipil-ipil (as it is called in the Philippines). The new clones of Leucaena leucocephala which were developed at the University of Hawaii by Dr James Brewbaker based on trees from Central America reflect one of the few attempts to apply plant breeding to a tree crop.

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[1]Senior Program Officer, Environment and Sustainable Resource Management Unit, Agriculture, Food & Nutrition Sciences Division, International Development Research Centre, P O Box 8500, Ottawa, Ontario, Canada K1G 3H9

[2]Director, CUSO/Thailand, 17 Phaholyothin Golf Village, Phaholyothin Road, Bangkhen, Bangkok 10900, Thailand

Leucaena was originally introduced to the Philippines and the western Pacific Islands by the Spanish about 1565. It was used for forage and firewood. It subsequently spread to Southeast and South Asia, Australia and Africa. In the past 20 years the fast growing "giant strains" (mainly three clones K8, K28 and K67) have become dominant.

These strains were faster growing than the so-called native types. They appeared to offer an excellent organic solution to small farmers and have proved very useful for:

1) forage for cattle, water buffalo and goats particularly during the dry season, commercial leaf meal plants also developed in Philippines and Thailand

2) fuel, most importantly for household cooking and charcoal which helped relieve pressure on natural forests, and also for large dendrothemal plants

3) wood for lumber, poles and pulp

4) reforestation particularly on poor soils and arid areas

5) soil improvement as contour strips on slopping land to prevent soil erosion and supply green manure and also used in traditional shifting cultivation systems to shorten the fallow.

These multipurpose trees were good but were oversold. I quote from a somewhat optimistic paper presented at the first "International Consultation on Ipil-Ipil Research" held in the Philippines in 1977: "Now we have a Super-marvelous Miracle Tree with nine fields for future fame and fortune. The nine super-marvelous attributes were fertilizer, forage, feed, food, firebreaks, fencing, fuel, fibre, and film (Curran, 1977). The author obviously got carried away, however, it does reflect the kind of thinking that fuelled the spread of the miracle tree. Although the tone at the second workshop on Leucaena in Singapore, 1982, had changed to one of caution and discussion of constraints such as lack of acid soil tolerance and the presence of animal toxins. There was even a paper "The miracle tree: Reality or Myth?"

This multipurpose nitrogen fixing tree was indeed wonderful everyone - farmers, development workers, local governments, donors, NGO's - liked it and promoted it. The results were large areas planted to leucaena. In Hawaii 55,000 ha for pasture, Australia 16,000 ha for fodder and in India leucaena was one of the major species used for reforestation. In S.E. Asia it is difficult to estimate the areas covered as much was planted by small farmers as hedge rows, farm yard and roadside plantings. However, in the Philippines about 20,000 ha alone was planted for dendrothermal plants, with considerably larger areas used for reforestation and hillside stabilization. Some of these plantings supplied the leaf meal industry which exported over 8000 tons of dried leaves in 1985

mainly to Japan. In Thailand areas in the south produced 50,000 tons of leaf meal while small farmers in the north were using leucaena for alley cropping and contour planting: in Vietnam and Laos it was used to reforest areas destroyed in the war. It was in the Eastern Islands of Indonesia where the greatest efforts were made to extend Leucaena such that the government rural development programs were described by the Indonesian word for Leucaena "Lamtoroisasi". It was promoted for soil conservation, livestock feed and reforestation, with at least 50,000 ha planted in the Eastern Islands. Elsewhere in Indonesia (Java and Bali) it has been used as shade for other crops - cacao. vanilla and pepper.

THE PROBLEM

A small insect a psyllid, the jumping louse. Heteropsylla cubana has spread from the centre of origin in Central America since its discovery in 1983 in Florida to Hawaii through the Pacific Islands to Philippines, Indonesia, the rest of S.E. Asia and recently to Sri Lanka and it is now moving up India (as of December 1989 it had reached Nepal) poised to take off for Africa. One theory is that it has hitchhiked on aircraft being attracted to the lights at night. It may have first taken military flights from Florida to Hawaii and commercial flights across the Pacific. It is also suggested that it travels on high altitude air currents. No matter what the mode of dispersal it is only time before it reaches East Africa and then to West Africa.

THE EFFECT

The primary damage is done by the young nymphs which feed only on the young shoots; their damage also results in secondary infection of black fungi (Fusarium and Oidium sp.). Continued attack leads to loss of leaves and dieback and sometimes death of the trees. The trees normally recover during the rainy season but the psyllid removes the leaves toward the end of the wet season. The cyclically defoliation seriously reduces the growth of the trees and removes the leaves at a crucial time when they are needed for livestock feed. The damage has been equally as bad on the "native" as the new giant strains.

The results have been disastrous to farmers. Farmers have lost income as leaf meal plants have closed, cattle have lost weight, died or been sold, reforestation and soil conservation efforts have been set back at least two years and some contours have washed out, while in Indonesia there have been unofficial reports of human starvation.

CONTROL

1) Chemical control -- Various experiments have been carried out to develop suitable control methods but in general they have not been effective even at weekly applications. The government of Indonesia tried aerial spraying and claimed success

although the farmers said they could not feed the leaves to cattle after spraying and when the spray wore off the psyllids returned.

2) Biological control -- A large number of predators and parasites have been reported associated with H. cubana including fungi, insects, spiders and birds but there has been no generalized control although in a few specific locations and environments there has been some control. There has been some controversy over the release of exotic predators particularly lady beetle predator (Curinus coeruleus) from Tropical America. It has been released in Indonesia, Philippines and Thailand while two other parasites have been released in Thailand. In the case of Curinus it is argued that it is a generalist predator and may also consume other psyllids particularly ones being used for biocontrol of Mimosa sp in Australia, Thailand and the Pacific. A survey is currently underway in the centre of origin for specific natural enemies that can be raised and released in S.E. Asia (CABI, 1989).

3) Resistance and substitution -- Resistance does exist in some strains, other species of Leucaena and interspecific crosses. The most promising are currently under going trials in various countries. However many of these even if found to be resistant, have not been tested for other agronomic traits important to farmers nor is there a ready seed supply to allow for rapid replacement. There are a number of other potential trees which are now being tested or used by farmers as replacement for leucaena. Gliricidia sepium is one of the most popular although at least 10 other species have potential for specific uses (Table 1).

Table 1 - Promising Multipurpose Trees for Use in Rows in South East Asia.

(NB. Local species may be as or more appropriate than introduced species. It is important to find out species already being used by farmers. Further information in Sustainable Agriculture Newsletter, Vol. 1, No. 1-3)

Species	Uses (code at end)	Comments
Acacia villosa	FW, Gr, Fd	May become weed, conflicting information on value as fodder
Cajanus cajan	F, Fd, FW, Gr	
Calliandra calothyrsus	Fd, FW, Gr	Does not tolerate water logging
Calliandra tetragona	FW, Gr	Poor fodder
Cassia siamea	FW, T, Gr	May not be N-fixing
Cassia spectabilis	FW, T, Gr	Not N-fixing but does very well on poor soil
Derris indica	FW, Gr	Also has insecticidal properties
Desmodium gyroides	Fd, Gr	
Desmodium renzonii	Fd, Gr	
Erythrina	FW, Gr	
Flemengia congesta	Fd, Gr	Excellent animal feed
Gliricidia sepium	Fd, FW, T, Gr	Most important as Leucaena replacement in many sites
Leucaena diversifolia	Fd, FW, T	Some resistance to psyllid
Sesbania grandiflora	F, Fd, FW, Gr	
Sesbania sesban	F, Fd, FW, Gr	

Code: F = human food, Fd = Fodder, FW = fuel wood, Gr = Green manure
T = timber including poles

ACTION-REACTION

In spite of the fact that leucaena had received considerable support for its promotion and an international organization, The Nitrogen Fixing Tree Association (NFTA) was involved in International Collaborative trials, the reaction time was very slow.

1) Governments - Generally slow to act then set up task forces accompanied by meetings, rhetoric and proposals for foreign donors. Indonesia however did react quickly alerted by events in the Philippines and undertook aerial spraying and pressure on researchers to find solutions.

2) Researchers - Attended meetings, wrote papers and proposals, and waited for outside donors to fund their research. A few started work on their own with local resources on biocontrol, resistance and substitution.

3) Donors - Slow to act -- proposals often got caught up in national and international intrigue, petty politics and institutional infighting. The smallest donors react the fastest.

4) NGO's - National and local did not realize the widespread nature of the problem because of few mechanisms for information exchange. Little contact between NGO's, researchers and government officials. Some International NGO's notably World Neighbours and CUSO played major roles in alerting farmers, other NGO's and government officials to the problem.

5) Farmers - They were the most affected and did the most reacting. They stopped planting leucaena , started testing other species, delayed soil conservation efforts and became more cautious of magic solutions and more aware of the need for diversity .

CURRENT ACTIVITIES

In spite of the delays, there are now in place, almost four years after the first psyllid was found in the Pacific Islands, a number of international and regional activities.

1) The International Leucaena Psyllid Trial Network coordinated by NFTA.

2) A Regional Research Plan for Leucaena Psyllid control coordinated by the F/FFRED project and USAID funded. A regional meeting was held January 1989 in Indonesia to review activities (F/FRED 1989).

3) Leucaena Psyllid Bio-Control coordinated by the CAB International Institute of Biological Control and funded by IDRC and ACIAR.

There is also increased networking and cooperation among NGO's:

1) Two issues of a regional sustainable agriculture newsletter have documented the advance of the psyllid across Asia based on readers responses and a third issue will discuss the various alternatives. These newsletters were reproduced and abstracted by various other organizations and had wide coverage.

2) There is increased sharing of information among involved NGO's about alternatives to tree species.

3) A regional NGO training course is planned as part of a developing NGO network.

MAJOR LESSON

The problems of leucaena and its pest could have been predicted, the dangers of monoculture are even present with miracle trees. The pest infestation is a message: it tells us of the vulnerability of the Leucaena system. It suggests we have to rethink and redesign. The principles of diversity and integrated land management - concepts to which Asian small farmers are no strangers, must be adopted by researchers and development workers.

Those of us from Asia worry when we hear of alley cropping schemes in Africa involving only leucaena. The psyllids are at Bombay airport ready to catch the next plane to East Africa. Please learn from the mistakes of Asia. There are no magic solutions, the silver bullets exist only on movie and TV screens. There must be a diversity of approaches and solutions.

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