Photo: Purna Chhetri

Leaves are spread in the main field

Local tree outyields chemical fertilisers

Farmers in Nepal use leaves of the 'asuro' tree to sustain soil fertility. Although locally well-known for its yield enhancing effects it does not seem to be integrated within farming systems at a wide scale. A call for more study.

Purna Chhetri and Gaye Burpee

Nepalese hill farmers increase crop yields with a multi-faceted local resource called asuro. The leaves of the asuro tree (*Adhatoda vasica* also *Adhatoda zeylanica* or *Jusiticia adhatoda*) are used as green manure in paddy rice, potato and corn fields. Leaves are chopped and applied to the surface of fields or flooded paddies prior to planting, where they decompose rapidly. According to Nepalese hill farmers, they need seven to ten days during summer, when daily temperatures are 27-32°C. Farmers report that application of asuro leaves to potato fields not only increases yields, but controls termite infestations too. Furthermore, because animals will not eat the leaves, asuro trees can be used as living fences (National Academy of Sciences 1980).

Growth conditions

Adhatoda vasica originated in India, Nepal and South Asia. It was introduced to Florida and the Caribbean (Cuba, Curaçao), where it is called La Vasaca, Castaña de Malabar, or Malabar nut tree. The tree is bushy, branchy and commonly grows to 2.5 meters, though it can grow to 6 meters. Leaves are elongated and emit an unpleasant odour when crushed (Geilfus 1989). The plant grows rapidly and coppices well (National Academy of Sciences 1980).

It can be propagated from seed or cuttings, will grow between sea level and above freezing altitudes and survives with 500 to 1600 mm of annual rainfall. It survives prolonged drought and tolerates infertile as well as alkaline soils. However, Geilfus (1989) warns that because it grows vigorously, *Adhatoda vasica* can invade uncultivated areas, such as pastures. Therefore, he advises that it should be planted in agricultural areas where adequate management can be provided.

Multiple benefits

Leaves, flowers and roots are used to treat fever, jaundice, typhus, diphtheria and respiratory tract infections, such as bronchitis and asthma (Geilfus 1989, National Academy of Sciences 1980). According to Geilfus (1989), the effectiveness of asuro as a green manure is enhanced by its insecticidal, fungicidal and herbicidal properties. It controls weeds in rice paddies. A liquid made from the steeped leaves kills adult ants and mosquitoes. In standing water asuro leaves kill mosquito larvae. And though not toxic to humans or domestic animals, asuro is toxic to fish as it contains the alkaloid vasicine (National Academy of Sciences 1980). The wood makes good firewood, excellent charcoal and burns with little or no smoke.

Farmers' findings confirmed

Local farmers' experience with the use of asuro has been confirmed by research at the Lumle Agricultural Centre (LAC) in West Nepal. Paddy rice treated with asuro at the rate of 10 tons of leaves per hec-

Manure	Production (tons/ha)	Straw Production (tons/ha)	Yield Increase %
Asuro (10 t/ha)	5.99	14.3	49
Compost (25 t/ha)	5.14	14.6	27.9
Fertiliser (60-30-30 kg NPK/ha)	4.02	29.8	10.2

Source: Sthapit 1988

Photo: Purna Chhetri

On her way back home after collecting asuro leaves

Potential

Nepalese travel great distances to collect leaves. The transport back home is mostly done by women and is burdensome. Inadequate availability during the cropping season is seen as an important constraint to the use of asuro too. The challenge of asuro lies in increasing research on its various properties and on socio-economic aspects, as well as promoting the use of this precious tree. It appears to have great potential for degraded, risk-prone environments in a wide range of climatic zones, similar to those where subsistence farmers till the soil. In Nepal, farmers travel great distances with purchased inorganic fertilisers on their backs. If more farmers knew about asuro and planted the tree nearby or on their farm, substantial time and money could be saved. ■

tare outyielded rice treated with chemical fertilisers by almost 40% (Table 1) (Sthapit 1988). If the benefits of asuro were due only to its properties as green manure and its ability to add macro-nutrients (nitrogen, phosphorus and potassium) to the soil, one would expect similar yields for chemically treated crops. Yet, in the LAC study, asuro plots produced 40% higher yields than chemically fertilised plots. These data suggest that asuro provides benefits above and beyond that of its potassium-nitrate rich leaves. In fact, asuro does have additional beneficial properties: insecticidal, fungicidal and herbicidal.

Editors' note

Exchange of experience with the use, promotion and research of *Adhatoda vasica* could be an interesting option. Who takes the lead?

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Green manuring with *Sesbania aculeata*

The production of high yields and their exportation from the farm means loss of nutrients which have to be replenished into the top soil. Especially nitrogen is an indispensable nutrient. Phosphorous and potash show to be less deficient than nitrogen. Until date Indian farmers have concentrated on farm yard manure and compost as main organic sources for recycling nutrients to their farm in addition to mineral sources of nitrogen that have been introduced in the past 30 to 40 years. However, these organic sources become more expensive and more scarce. Therefore, many farmers focus more and more on growing leguminous green manure crops within their own plots. Although these crops do not really recycle any nutrients they are able to bring in nitrogen, they also improve soil structure, and last but not least they are cheap in monetary terms. A crop commonly used in India (Assam, West Bengal, Bihar, Tamil Nadu) is 'dhaincha' or *Sesbania aculeata*. Depending on circumstances it can produce 8-25 tons of fresh matter per hectare while fixing some 60-90 kg N, equalling some 3-10 tons of farm yard manure. It contains 0.62% nitrogen. It grows on waterlogged and alkaline soils. It should be sown immediately after the onset of the rains. Best moment for ploughing it under is when flowering begins. C/N ratio is low and the greatest bulk of succulent organic matter is available. The latter makes decomposition more rapid. Later ploughing means higher C/N ratio, reduced release of nitrogen, and easily leads to N-deficiency in the following crop. So dhaincha should be incorporated into the soil after some five to six weeks after sowing. Light soils require deeper incorporation than heavier soils. Spectacular improvements of its performance can be achieved when additional phosphorous is applied.

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Sesbania sesban in support of grass fodder

Here are some first experiences with a mixture in Australia. Of all leguminous crops that greatly interest agriculturalists, *Leucaena leucocephala* has attracted most attention, which has led to a folly of its planting. However, problems with the psyllid infestation have pressed practitioners and scientists to look for other species and for opportunities to grow crops in mixtures. One such species is *Sesbania sesban*, a small tree or shrub growing 6 metres. It is well branched, with abundant, soft pinnate leaves with a protein content of around 28% and a high digestibility. It has been reported to grow over a wide range of climatic and soil conditions including water logging and saline sites. A project run by the Department of Agriculture, University of Queensland, was to establish most productive lines, to assess its nutritive value and to multiply seed reserves of promising lines. Five different sites were selected but all prone to inundation and all except one with low soil fertility. Five accessions (ILCA 15022, ILCA 15036, ILCA 9265, ILCA 10865, CPI 30071) were tested in comparison with *Leucaena leucocephala* cv. Cunningham. Seeding rate was 3.6 kg/ha while a basic fertiliser dressing of superphosphate and muriate of potash was given. Plants were cut at a height of 1.5 to 2 metres. ILCA 15022 and 15036 proved to outyield the other three sesbania species as well the leucaena. Yields of edible herbage were 3 and 12 t/ha/year in two locations whereas yields at the other sites were low. It showed not to be tolerant to heavy frosts. At some sites inoculation with effective Rhizobium was necessary.

A trial was set up in one site on a poorly drained infertile podzolic soil of pH 5.3 in which a pure stand of signal grass (*Brachiaria decumbens*) with 200 kg N/ha/year was compared with a mixed stand of signal grass and CPI 30071. The *S. sesban* was sown in rows 4 metres apart and the signal grass in the inter-row area one month later. Five months later, heifers started to graze the stands. The mixture was grazed on a rotational basis of 2 weeks on - 6 weeks off while the signal grass was grazed continuously. In the early stages the cattle showed marked preference to the signal grass but after 3 months when the grass began to hay off, the sesbania started to be browsed much more. Over a period of 12 months (July '90 - July '91) the average live weight gain for animals on the mixture was 0.70 kg/head/day while animals fed on signal grass alone gained 0.40 kg/head/day. Although there were no apparent toxic or anti-nutritive effects of the sesbania, this aspect will be further researched upon. Browsing of the shrubs caused relatively high damage as they are quite brittle: after 14 months of grazing and under rather dry conditions some 22% of the sesbania had died.

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