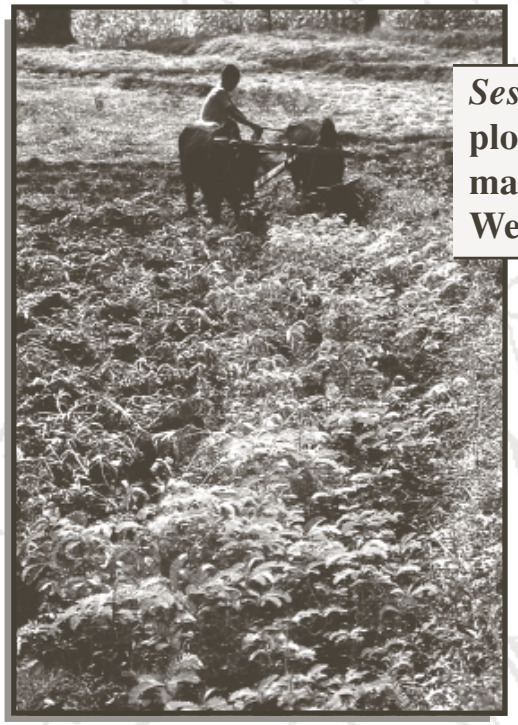
What are Green Manures ?



***Sesbania* being ploughed in as a green manure , Surkhet, Western Nepal**

Every farmer knows how much work goes into the production of a basket of compost and carrying it to the fields. But it never seems that the farm production gives an equal return for the hard work that goes into making and carrying the compost. **Green manures** are a method of replacing that basket of compost with a handful of seed. In this method, the plants that grow from the handful of seed are ploughed back into the soil. After a while in the soil, the plants rot down to become compost. Plants used in this way are called **Green Manures**. It's a very good way of increasing the fertility of the soil, and can give huge benefits for farmers. So let's read about it here.

Why grow Green Manures ?

Benefits of Green Manures

- **Reduce the need for artificial fertilizers** - by using green manures the need to bring in fertilizers is reduced. By not using fertilizers, costs are saved and the soil is not damaged. Also, production can be increased to feed the family for longer, or excess produce can be sold.

- **Increase biomass production in the fields** - in an example from Brazil in South America, where 40,000 farmers have converted to using green manures, they have calculated that using velvet bean as a green manure has produced **50 to 140 tons per hectare** of extra biomass. This is the equivalent of carrying up to 3000 loads of leaf litter! But the green manure biomass doesn't need to be carried from anywhere. Wherever the fields are, that's where the biomass is produced and, that's where it rots to form compost.

- **Increase in micro-organisms and their activity in the soil** - Beneficial micro-organisms live and work around the roots of green manure plants in the soil. They help the plants to catch and create nutrients in the soil. The fertility isn't just for the plants, it helps to make the soil rich. The microorganisms help the plants and the soil, and in return the green manures help to protect the microorganisms from being damaged by the sun, wind, rain, leaching, etc.

- **Increase Farm production** - using green manures can increase the production of grains, pulses, vegetables, fodder, fuel, etc. grown on the farm.

- **Decrease work and expense** - less compost needs to be carried. By using green manures, the soil becomes loose and easier to plough or dig.

- **Reducing weeds -** green manures cover the ground and so reduce the work and cost of weeding.

- **Protect the soil** - by covering the soil, green manures protect it from the damaging effects of hot sun, wind and hard rain.

- **Improve the soil** - where green manures have been regularly used the soil is softer, lighter and easier to work. As a result, the soil has a greater capacity to absorb and store water and nutrients.

- **Improve the quality of crops** - crops grown with green manures are more tasty and nutritious than those grown with chemical fertilizers.

Mr Thek B. Gurung of Gumi VDC - 4, Surkhet, likes using *Sesbania* green manure on his fields

How to grow Green Manures ?

There are 2 ways of using green manures :-
1. When land is unused, or fallow between crops;
2. While crops are still growing in the fields.

1. Using green manures as fallow

When crop land is empty after crops have been harvested, green manure seeds can be sown as thickly as sowing wheat. When the green manure plants are about to flower they can be cut and left, or ploughed into the soil.

2. Using green manures mixed with crops

This method is used mostly with maize growing. An easy method is to sow a green manure at the same time as maize, and then dig it in when it is time to weed the maize (after 3-4 weeks). At this time green manure seeds can also be sown, and the green manure is cut and mulched or ploughed in after the maize is harvested to provide even more fertility.

Green manures are easy to use, but it's important to note certain things, such as :-
- green manures can be used in all seasons;
- which-ever type of green manure is being used, they will give most benefit to the soil if cut and/or ploughed in at flowering time, before seed is set;
- climbing types of green manures can smother the crops they are growing with. If so, the climbing stems need pulling down from the crops.

Selecting which green manures to use.

There are many plants which can be used as green manures. In particular, the type of green manure should be selected according to the type of crop it is growing with or in between. For a large plant like maize, a large green manure like velvet bean or *Sesbania* should be used. For a short crop like many vegetables, smaller green manures such as mustard or buckwheat can be used.

Criteria for selection of green manures include :-

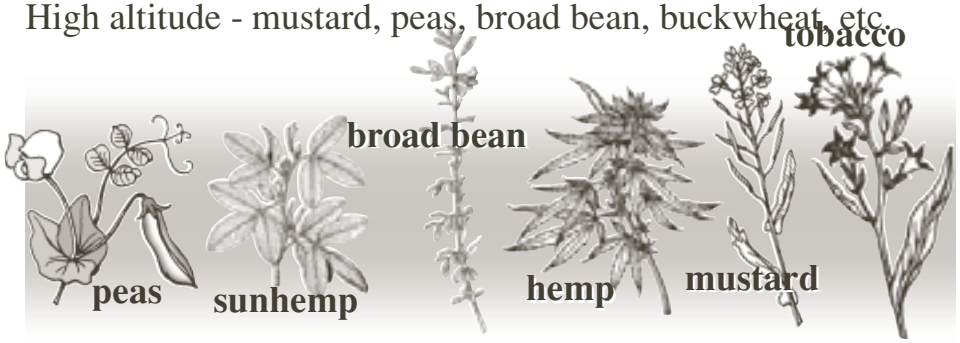
- plants are fleshy and soft
- fast growing;
- fast to decompose;
- leguminous;
- don't attract pests and diseases;
- don't compete with crops;
- provide nutrients needed in the soil (more information about this is given on p.21)

Examples of winter-grown green manures

Low altitude - mustard, peas, broad (fava) bean, fenugreek, tobacco, buckwheat, etc.

Mid altitude - mustard, peas, broad bean, fenugreek, buckwheat, etc.

High altitude - mustard, peas, broad bean, buckwheat, etc.

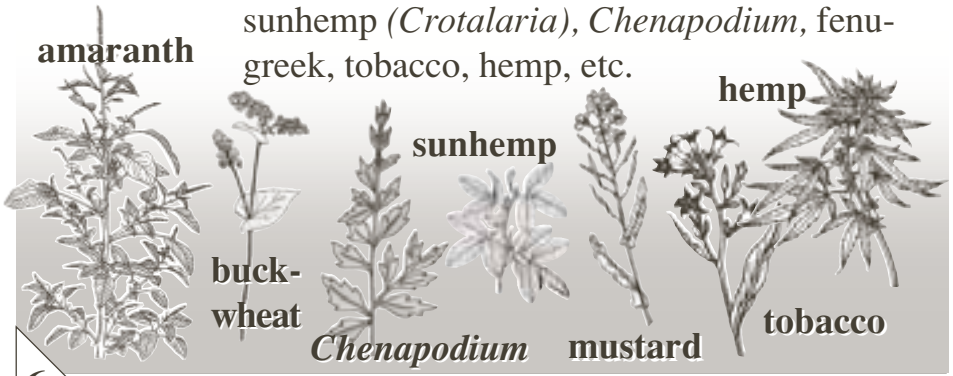


Examples of summer-grown green manures

Low altitude - mustard, buckwheat, amaranth, sunhemp *(Crotalaria), Sesbania, Chenapodium,* fenugreek, lab lab, velvet bean, jack bean, tobacco, etc.

Mid altitude - mustard, buckwheat, amaranth, sunhemp *(Crotalaria), Sesbania, Chenapodium,* fenugreek, lab lab, velvet bean, jack bean, tobacco, hemp, etc.

High altitude - mustard, mustard, buckwheat, amaranth, sunhemp *(Crotalaria), Chenapodium,* fenugreek, tobacco, hemp, etc.



Examples of using green manures

Now we'll see some specific examples of green manures. On this page *Sesbania* is used with rice. On page 17 *Sesbania* is used with maize, then on page 18 velvet bean is used with maize, and on page 20 mustard is used with wheat.

Sesbania and Rice

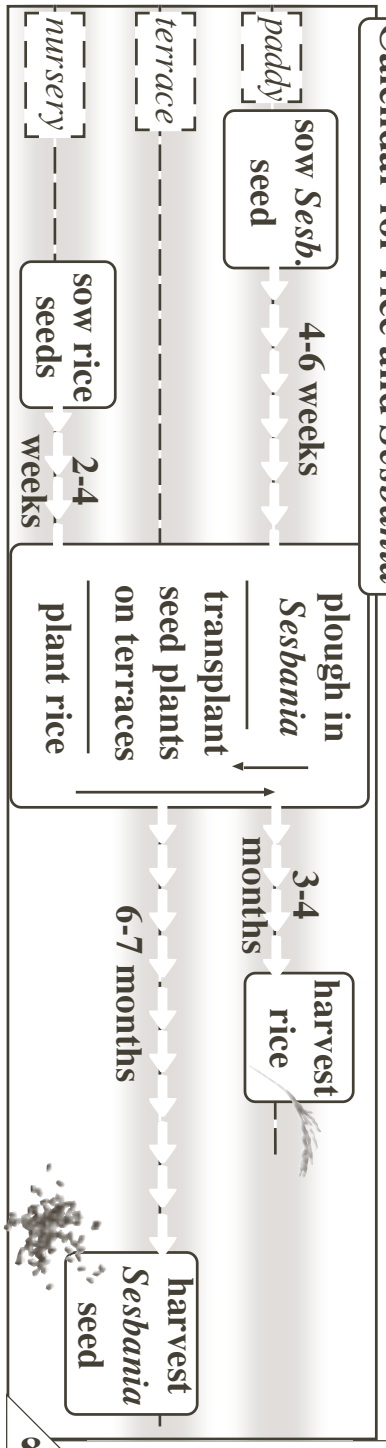
In this method, *Sesbania* is sown before rice is planted. As rice is sown into nurseries, all other paddy areas are fallow, which is when *Sesbania* can be grown.

How to sow	Sow the *Sesbania* as densely as wheat or mustard seed. Then lightly till to cover the seed with soil.
Timing	Sow after winter crop is harvested, or in the Spring. *Sesbania* will grow faster if the soil is kept moist, so irrigate if possible. After 4-6 weeks, the *Sesbania* will be 18-36 inches tall. Cut at ground level and plough in as the paddy are prepared for planting rice.

Seed production of *Sesbania*

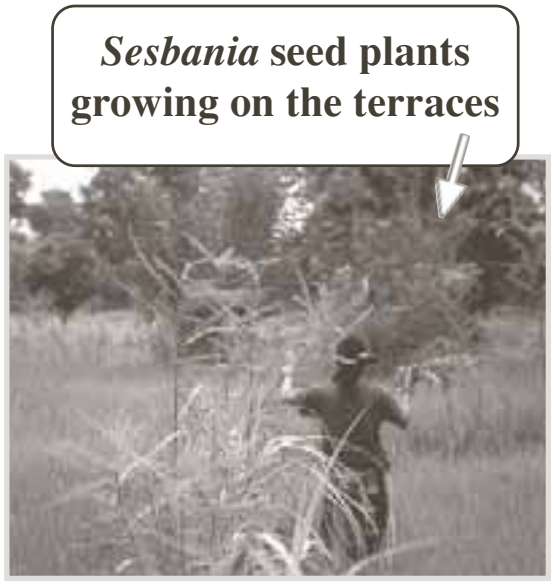
When *Sesbania* is being ploughed in during paddy preparation, transplant a few of the largest, thickest, healthiest plants onto the edges of the paddy - space at 2 metre intervals along the terrace edges. These will grow on to produce seed for green manure use next year. The seed will be ready after 6 to 7 months

Calendar for rice and *Sesbania*



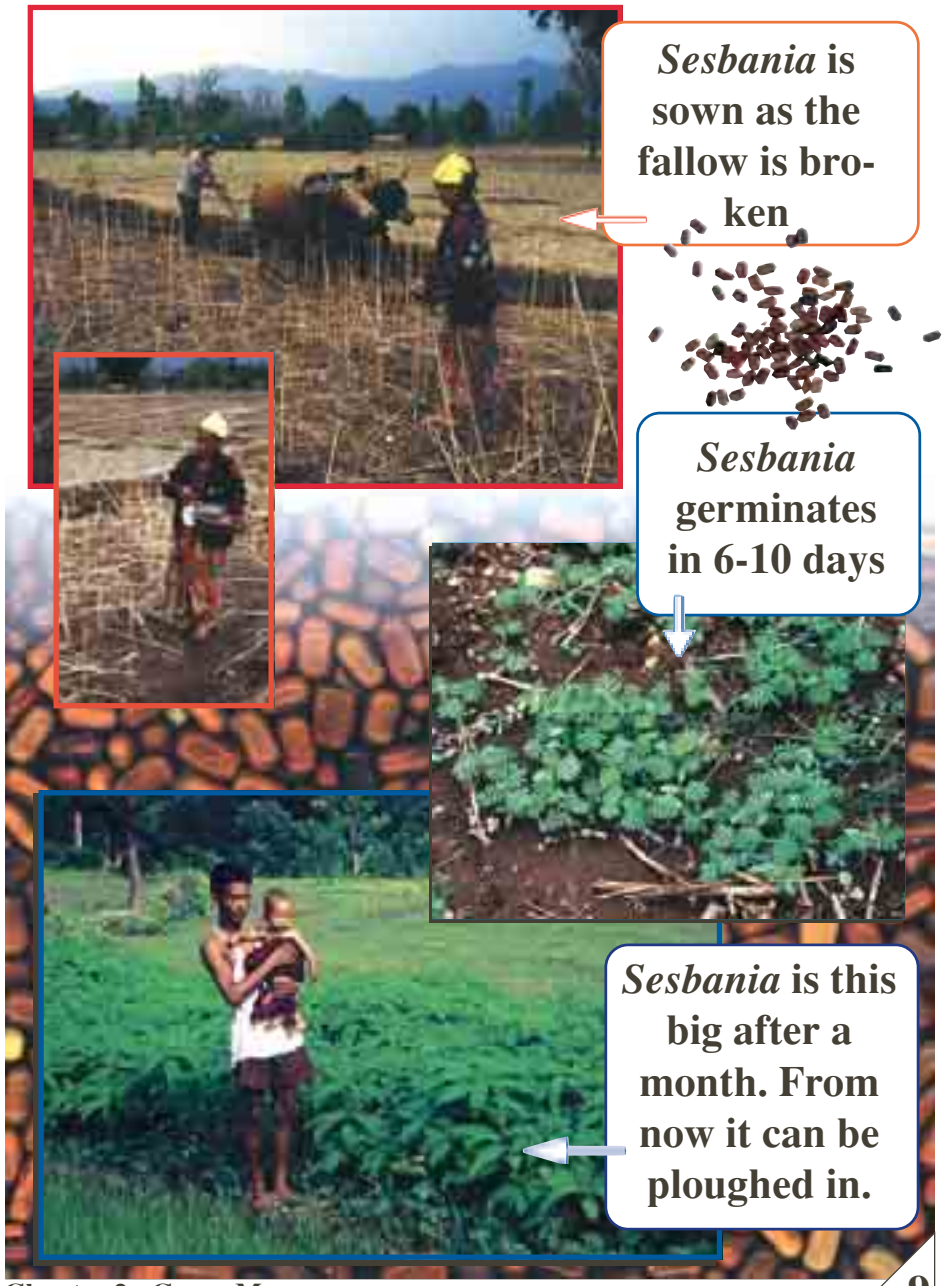
Seed plants will grow at 2 metre intervals on the terrace edges. When between 1-1.5m tall, pinch out the tops. This helps to thicken the stem and prevents the plant growing too tall, when the wind can blow them over. Pinching also produces more branches, and so more seed. There's a picture of this on p.11.

After the *Sesbania* has been cut and ploughed in, the paddies are flooded, and rice is planted. The fertility from the rotting green manure is a good food for the rice.



***Sesbania* seed plants growing on the terraces**

Let's See how to grow Green Manures



***Sesbania* is sown as the fallow is broken**

***Sesbania* germinates in 6-10 days**

***Sesbania* is this big after a month. From now it can be ploughed in.**

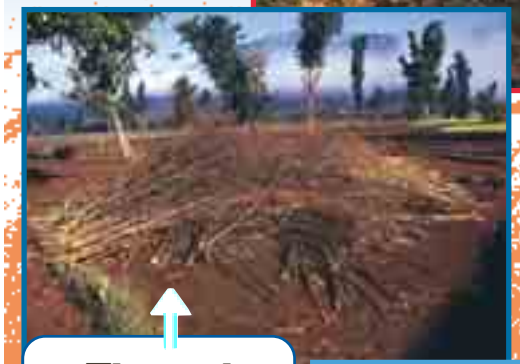
The *Sesbania* is cut at its base before ploughing in.

This makes ploughing easier

Land ready for planting after *Sesbania* has been ploughed in

The tips of the *Sesbania* seed plants are pinched out. This makes more branches, and the plant has a stronger stem.

After the rice is harvested the *Sesbania* seed is ripening



The seed plants also provide a fire-wood yield.

Seed is cleaned and stored for next season

Sesbania or velvet bean is sown as the maize is weeded for the first time

If maize is also weeded by hand this is still the time to sow green manure

Sesbania grows amongst the maize

The *Sesbania* is ready to plough in after the maize is harvested

Velvet bean growing as a green manure

A Guatemalan farmer inspecting the velvet bean after the maize has been harvested

The velvet bean is cut at the roots when it starts to flower

Velvet bean after it has been cut

Velvet bean flowers and seed pods

This wild "weed" is also a good green manure plant

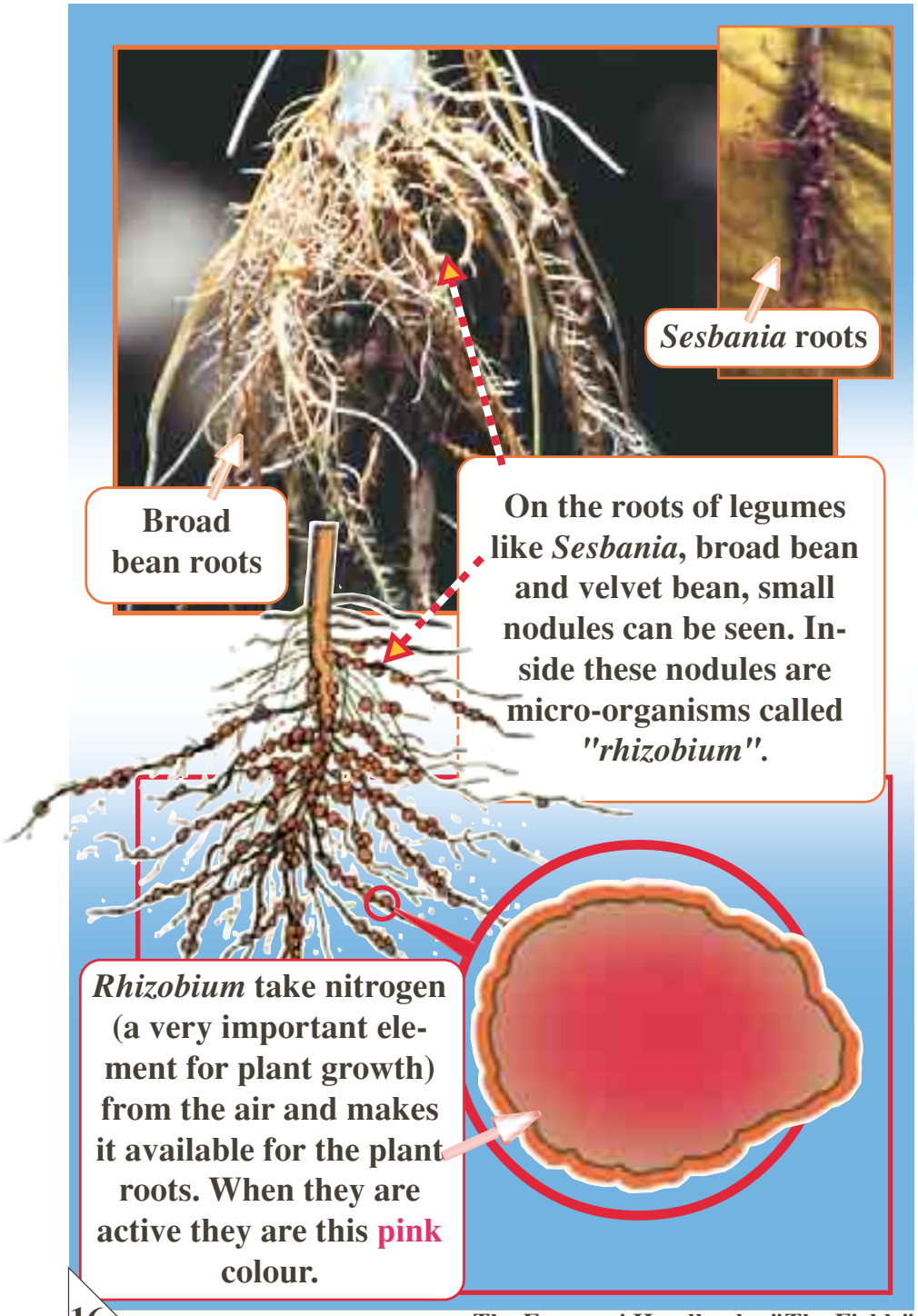
Sunhemp used as a green manure with millet

White clover is sown as a green manure in a fruit tree nursery. This keeps weeds down, conserves water, and adds nitrogen to the soil.

Perennial white clover

Agroforestry on the terrace edges and velvet bean green manure in the maize

2 years before, the soil on this Guatemalan farmer's fields was too poor for farming. After using velvet bean as a green manure, look how black the soil has become and how big the corn is (also see p.22)



Sesbania and Maize

In this method *Sesbania* is sown with maize. There are 2 methods of sowing the *Sesbania* as a green manure with maize .

Method 1 :- Sowing *Sesbania* at the same time as maize.

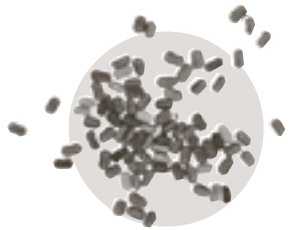
- The maize and *Sesbania* germinate together. The *Sesbania* is dug or ploughed in when the maize is weeded after 3-4 weeks, and the fertility from the *Sesbania* helps the maize crop.
- Instead of *Sesbania*, many other types of green manure can be used to provide nutrients for the maize.

Method 2 :- Sowing *Sesbania* when maize is being weeded

- As maize is being weeded for the first time, 3-4 weeks after sowing, sow *Sesbania* as thickly as you would sow wheat. While weeding, the *Sesbania* seed will be covered.
- After the maize has been harvested, the *Sesbania* is cut and ploughed in as the land is being prepared for the next crop.
- The fertility from the *Sesbania* will benefit the next winter crop.

Sesbania seed production

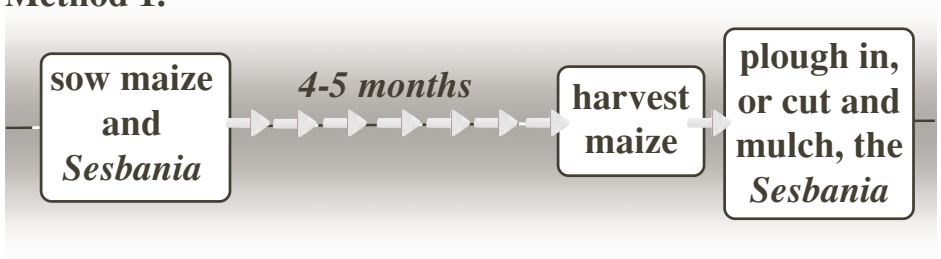
Sow seeds on the terrace edges. Select as many of the best plants as are needed for growing on to produce seed.



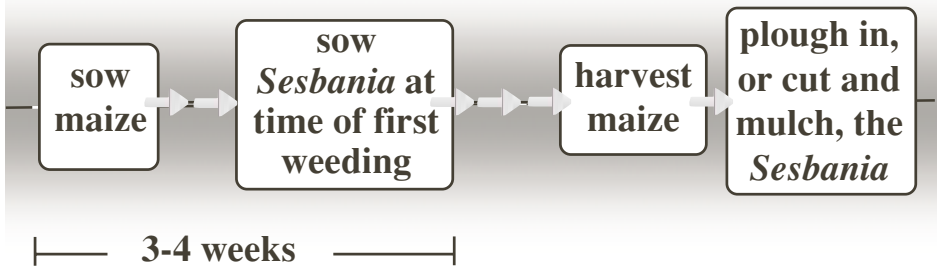
Other green manure types can be used instead of* Sesbania, *but they need to be tall plants, (like maize), for example sunhemp. See also velvet bean and maize, p. 18

Calendar for maize and *Sesbania*

Method 1.



Method 2.



Velvet bean and maize

In this method, velvet bean is grown as a green manure with maize. Velvet bean is sown as the maize is weeded for the first time.

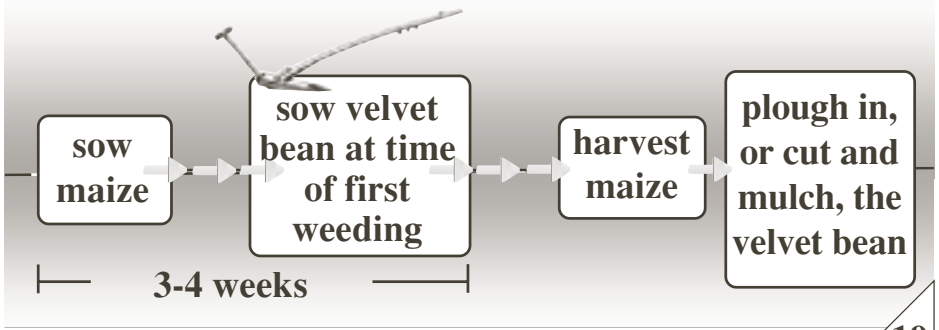
- Maize is weeded by hand or ploughed 3-4 weeks after sowing. At this time, sow velvet bean seed 50cm apart. The seed is covered with soil when weeding.
- The velvet bean will germinate quicker if it is soaked in water for 2 days before sowing. While soaking the velvet bean seed, change the water twice a day.

- The velvet bean is a climing type and will grow into a large vine. If it starts to smother the maize before the maize is harvested, it should be pulled off the maize plants onto the ground. After the maize is harvested, the velvet bean can be allowed to smother the standing maize stalks to put on extra biomass.
- After the maize has been harvested, the velvet bean is cut and ploughed in as the land is being prepared for the next crop, or cut and mulched if the land is to be fallow.

Velvet bean seed production

- Plant velvet bean seed on the field edge, under a suitable tree, and allow it to grow up the tree to produce seed. Don't let it climb on fruit trees as the large, thick vine can damage the fruiting of the tree.
- Velvet bean seed will be ready to harvest about 8-10 months after sowing.
- Velvet bean seed is not edible for people.Edible climbing beans can be used instead of velvet bean, such as lablab, Jack bean, etc. These can be allowed to produce a bean crop if timing is appropriate.

Calendar for maize and velvet bean



Mustard and Wheat

In the autumn compatible green manures can be sown with winter crops. It is difficult to grow green manures together with crops like wheat or barley, so they are usually grown before the grain crops.

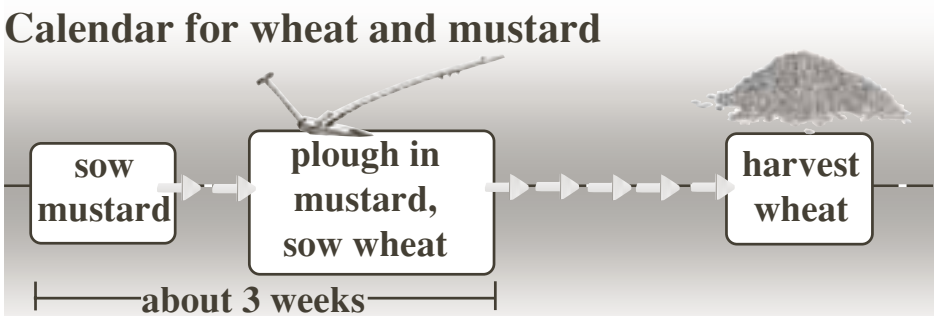
Timing

- The green manure can be sown while land is fallow, after harvesting the summer crop.
- After harvesting the summer crop, such as rice or maize, the land is ploughed as normal, and mustard is thickly sown.
- The mustard should be ploughed in as it starts to flower.
- Then the winter wheat (or any winter crop) is sown.

Instead of mustard, buckwheat or fenugreek can also be used in the same way as green manures.

Mustard is ploughed in at flowering time for use as a green manure. Here, wheat is then sown.

Calendar for wheat and mustard



There are many other types of green manure that can be used as well as the above examples.

"I sowed sorghum as a green manure. After a month I ploughed it in and planted potatoes, and got 3 times the production !"

Bhim B. Gautam, Gumi, Surkhet

Below is some information about which green manures have high amounts of particular nutrients

Type of green manure	Nitrogen	Phosphorus	Potassium
buckwheat		lots	
mustard		lots	
tobacco		lots	
Chenapodium	lots	lots	lots
Sesbania	lots		
beans	lots		

A story about Hurricane "Mitch"

In 1998 Hurricane Mitch struck Central America, especially Honduras, Guatemala and Nicaragua. Strong winds, torrential rain, landslides and floods killed over 10,000 people and left 300,000 others homeless.

Farmer Yuwan Aguirre pulls back the thick mat of biomass resulting from a velvet bean green manure crop. This has helped to protect againts soil erosion and raise production.

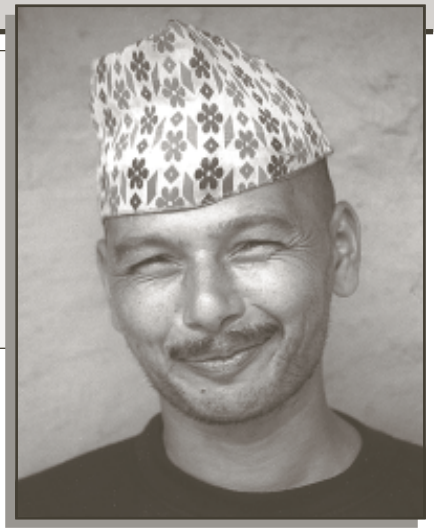
But in the south of the Lempira region there were no disasters. No landslides, no deaths, in fact 84 villages in the region produced 2000 tonnes of surplus grain. To explain these amazing facts, the government, along with local NGOs and farmers studied the area and found that the farmers there had been implementing sustainable, organic agriculture practices that had protected them from the dangers of natural disasters. Since the last 30 years, over 10,000 farmers in these villages had been implementing soil conservation, terrace improvement, agroforestry, green manure and integrated pest management strategies to protect the steep slopes in their areas. Because of this, even a huge natural disaster like Hurricane Mitch wasn't able to cause them any serious damage.

Since the beginning of their experiences, the farmers of Lempira have been sharing their lessons with local farming organisations and with farmers throughout the country and in neighbouring countries too.

Farmers' Experience

Mr Dambar Bahadur Regmi

From Nepal, Surkhet district, Gumi - 3, Mr Dambar Bahadur Regmi has grown green manures since 1995. Now let's hear about his experience.



Dambar Bahadur Regmi

" I've seen myself the benefits of growing *Sesbania* green manure with rice paddy. Ever since I started doing this, the production of rice has increased steadily. Land that used to produce 960kg of rice can now produce up to 1400kg, which is pretty good for this area. Also, I've spent less buying fertilizers from the supplier since using green manures. The soil has become softer and easier to plough, so you need to do less work and still get better crops. Rice that's grown this way tastes better, too, and the mill owner tells us that there's less husk and more grain in my rice and that of other farmers who've started using green manures. Now I want to try using other types of green manure as well as *Sesbania*. "

This chapter's author
Ms Hommaya Gurung
Coordinator, Himalayan Permaculture Group, Surkhet, Nepal

Read On !

Subjects Related to Green Manures

This book provides enough information to be able to grow your own green manures. However, this information is also linked to other methods. For extra benefits let's read, learn and practice from other related chapters.

Seed Saving chapter

This chapter gives information on methods to produce and store various types of quality seeds, including green manure seeds, at home.

Compost chapter

As well as green manure, animal compost is also useful for plant food, but needs to be produced in a well managed way. This chapter shows how to produce a quick rotting, good quality compost.

Kitchen Garden chapter

How to make and manage a home vegetable garden for permanence, ease and simplicity ? This chapter shows how to produce a wide range of fresh vegetables by doing less work for more production.