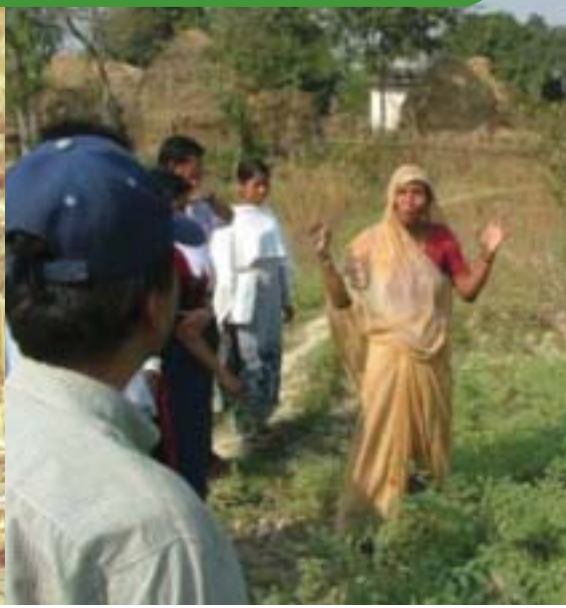
Research into Use: Pocket Guide No. 8

Profitable pulse crops **transform rice fallows**

Research Into Use

In South Asia vast areas lie fallow after the rice harvest. Short-duration pulse varieties, early sowing, minimal tillage and seed priming are set to change this dramatically.



Above: In South Asia, nothing grows in the rice fallows that cover huge areas in the post-rainy *rabi* season (left). But by growing hardy pulses such as chickpea (right) after rice, farmers can greatly increase their returns. Photos: D. Harris

In Bangladesh, India, Nepal and Pakistan, over 14 million hectares of fertile land lie fallow in the *rabi* season following the monsoon. Where there is no irrigation, most fields are not cultivated once rice has been harvested. People in these areas are overwhelmingly poor and malnourished, and often up to half of them cannot read and write.

This guide outlines some simple low-risk options that could help these people grow more food and make more money, by planting pulse crops on fallow lands.

Making the most of fallows

After the rice harvest, farmers traditionally avoid growing crops. In the *rabi* season rains are erratic and droughts mean crops frequently fail. Although some moisture remains in the soil, farmers find that seed germination is uncertain as the paddy fields dry out and hard layers of soil (hard pans) form. Their crops often don't mature before drought sets in. And livestock set loose to graze the fallow fields damage their crops. Most farmers see post-rainy season crops grown without irrigation as being very risky.

Many of these farmers are beyond the reach of over-extended extension services. So they don't know that there are now simple ways to overcome the problems of *rabi* season crops. Early-maturing varieties of hardy pulses, low-cost seed treatments and simple farming practices mean less risk and good returns.

Rabi crops can also provide work at a time of year when agricultural labour—which accounts for over three-quarters of the population in Nepal and two-thirds in India—is mostly idle. For example, one hectare of chickpea employs someone for 50 days. Very simple projections suggest that if only one-third of all rice fallow land was used to grow pulses, it could provide rural workers with 95 million days of work in the *rabi* season in India alone.

Farmers can profit from pulses

After the monsoon *kharif* season, once rice has been harvested, paddy field soils are still damp. These soils are usually highly fertile.

Above: Rice growing in the monsoon *kharif* season.
Photo: D. Harris

Above: Land left fallow in the *rabi* season.
Photo: D. Harris

So, instead of just leaving the fields fallow during the *rabi* season, farmers can use the moisture left in the soil to grow pulses. Pulses, or legumes as they are also known, have deep roots and can be grown without irrigation.

Soybean, mung bean, black gram, pigeonpea, groundnut, chickpea, lentil, khesari, faba bean and pea are all suitable for fallow paddies. But rice fallow areas vary widely. Involving farmers helps the development of varieties adapted to

differing climates, soils and consumer preferences.

At the end of the monsoon, soils quickly dry out. But seed priming—soaking seed overnight in water—helps germination and gives seedlings a head start. This simple practice raises yields of chickpea by over 40 percent and costs practically nothing. Farmers who tried it found their incomes were 12 percent higher than those who didn't.

Pulses are hardy and, unlike crops such as wheat that must be irrigated in the *rabi* season, they need little in the way of capital or inputs. Including legumes in rice rotations adds nitrogen and organic matter to the soil and improves rice yields—a bonus as returns from rice are falling.

Pulses are more profitable than irrigated *rabi* crops such as wheat because they have low input costs and the grain fetches high prices. Demand in the region is strong and set to rise. Domestic supplies are already inadequate and most countries import large quantities. The young shoots and green pods of chickpea are popular as a vegetable and snack, and also fetch good market prices.

Pulses are important as a low-cost protein food. For vegetarians—who make up a third of the region's population—they are a vital part of the diet.

Introducing *rabi* pulse crops to rice fallows is low-cost and can raise both yields per hectare and incomes for some of the region's poorest farmers. Plus, rice—pulse rotations conserve both land and water while producing more food and employing more labour.

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Involving farmers helps the **development of varieties** adapted to differing climates, soils and consumer preferences

Above: In the Barind of Bangladesh, low-input chickpea (right) gives better returns than irrigated wheat (left).
Photo: D. Harris

Growing crops in rice fallows: the practicalities

Start the process with farmers

It's been found that the best way to introduce farmers to pulses as a fallow crop after monsoon rice is to find a small group of interested farmers and work with them. Each farmer needs to agree to plant pulses on part of his/her land. If possible, the plots should be next to each other and about 2-3 hectares in all. This makes it easier to protect the trial plot from grazing animals.

Work towards getting early rice harvests

The earlier rice can be harvested, the earlier the follow-on crop can be sown. Early harvests mean that more moisture remains in the soil for the next crop. Early-maturing varieties, developed in partnership with farmers, are now available that can bring the rice harvest forward by ten days or more. This makes a big difference. Another way of bringing the harvest forward is direct seeding where, instead of transplanting rice seedlings, rice is sown directly into paddies. In this case, more resources need to be spent on weeding.

Conserve soil moisture

It's important to keep as much moisture in the soil as possible. This means minimum tillage—quickly preparing the soil for sowing without too much disturbance.

Treat seeds before sowing

'Priming', that is soaking seed overnight, helps seed germinate and gives seedlings a head start. After priming, the seeds need to dry just enough to be sown easily. Soaking chickpea before sowing costs practically nothing yet has proved outstandingly effective in many places, including northwestern Bangladesh.

Seed priming is easy, low-cost, low-risk and very effective

Soak seeds for 4-6 hours in water. For each kilogram of seed, add 0.5 g sodium molybdate in 1 litre of water and 5 g *Rhizobium* inoculum in 1 litre of water.

Adding *Rhizobium* to the soaking water helps the seedlings form nitrogen-fixing nodules which capture nitrogen from the air. This is especially true where soils are acid, which is often the case in rice paddies. Molybdenum is an essential micronutrient for chickpea. Tiny amounts of molybdenum improve *Rhizobium* nodulation.

Soaking seed in water alone dramatically improves germination. But, priming seeds with both molybdenum and *Rhizobium* (as above) raises yields by a third compared to priming with just water.

Choose pulse varieties that mature early

The varieties for follow-on pulse crops need to flower and set seed early. This is because they need to be ready to harvest in 75-80 days—before they have used up all the soil moisture. Normally chickpea takes 120 days to mature.

Above: Soaking seeds overnight (priming) gives higher yields of yellow chickpea (right) than planting non-primed seeds (left). Farmers and researchers have worked together to determine the optimum soaking time for many of the crops that smallholders in the semi-arid tropics depend upon for food and income. Photo: D. Harris

And, choose pulse varieties that are resistant to common local pests

In some areas, pests such as pod borers can be a problem. Here it's important to choose pest-resistant varieties or crops that aren't so susceptible. What's more, integrated pest management (IPM) is very important in low-input *rabi* crops. IPM can include the use of nuclear polyhedrosis virus (NPV) as a spray. This is very effective in controlling pod borers when they are detected on leaves in the late stages of crop development.

Farmers know what works for them

Involving farmers in choosing and testing varieties—known as participatory varietal selection—helps match crops to local soils, climate, markets and consumer preferences. Farmer trials with minimum external inputs—just seed, labour and bullocks—can be very cost-effective.

Seed priming is **easy, low-cost, low-risk** and **very effective**

Above: The contrast between fallow and cropped land is clear. Photo: D. Harris

Participatory varietal selection is a way of choosing crop varieties that:

- Includes farmers' criteria in searching for varieties to test
- Meets farmers' preferences and needs
- Lets farmers try out varieties in their fields
- Distributes the varieties farmers prefer.

Extension services are stretched to the limits—look into who else can help

Farmers often have to travel a very long way to get advice from extension services. And not many can tune in to radios or TVs as a source of advice. Increasingly, the trend is for NGOs and extension services to work closely together. For example, in eastern Nepal the area of rice fallow sown to crops doubled from 40 percent to 80 percent in two years thanks to the NGO FORWARD (Forum for Rural Welfare and Agricultural Reform for Development) and the local District Agriculture Development Office (DADO).

Farmers need the right seed at the right time

Quality seed of the right variety at the right price at the right time is a must. Schemes that help communities to become self-sufficient in multiplying, storing and distributing seed have proved effective. Examples include buy-back seed production schemes and village seed banks where farmers contribute seed from improved crops and varieties. Village entrepreneurs can also play a role here.

Low-cost seed storage

Stored seed is prey to beetles, rats and other pests. Tested ways to safely store seed on-farm include sun-drying seed, putting seed in thick polythene bags, making bags airtight, mixing seed with naphthalene balls and storing bags of seed on raised platforms in large containers.

Looking after *rabi* crops

During the *rabi* season, free-ranging livestock graze fallows and damage growing crops. Livestock can be kept out more easily if farmers get together to plant in blocks. Block planting also means that between them, farmers are more likely to spot and treat pests and diseases at an early stage.

A big advantage of legume crops is that they have nodules on their roots that fix nitrogen and so don't need lots of fertiliser. Where soils are poor, adding manure, or superphosphate if farmers can afford it, improves yields.

Above: Chickpea has nodules on its roots that fix nitrogen from the air—giving a free source of fertiliser. Photo: D. Harris

Marketing *rabi* crops

Chickpeas, lentils and other pulses find ready markets. In Madhya Pradesh, farmers feared that they would find soybean—a new *rabi* crop—difficult to sell. However, these fears proved groundless. The area of soybean quickly grew and transformed subsistence farming into commercial farming. Farmers here also found that the problem of grazing animals destroying crops went away rapidly as the benefits of soybean production became clear and villagers cooperated to keep animals under control.

Prices play a big part in farmers' choice of crops. Though some countries, for example India, guarantee minimum prices for pulses others, such as Nepal, do not. Involving farmers in choosing crops and varieties means that they pick only those that they know will fetch good prices and that local consumers will accept.

Prices play a big part in **farmers' choice** of crops.

Above: Chickpeas, lentils and other pulses find ready markets

For more information and contacts, please see the back page.

How can I find out more?

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See also **www.seedpriming.org**

About this series

Research into Use *Pocket Guides* showcase new technologies that have been tried and tested, and have proven successful in the field. They were produced to demonstrate the importance of high-quality scientific communication.

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