

## Living in dry areas

Smallholders who live in the tropical drylands have to cope with two realities of their natural environment: they live in a dry place and their rainfall is unreliable. Although they receive between 250mm and 1000mm of rainfall each year, it unfortunately comes in one or two short seasons barely long enough to grow a crop. For the rest of the year there is little or no rain. Domestic animals lose weight and in drier years can starve. They may have to be watered from wells, consuming much labour. So rainfed farming consists of short periods of intense and exhausting work separated by long periods of inactivity.

Rainfall variability introduces risk into most life-supporting activities and the impact of variability increases with aridity. While this can be measured in probabilities, enabling an assessment of risk and returns from agriculture to be made, no one can predict the timing or intensity of droughts.

### MANAGING THE RAIN

Various agronomic practices have long been established to help mitigate the effects of drought and it is well known that land preparation and planting methods largely determine the success of crop establishment, the intensity of weed growth in the crop and the resources that farmers must invest to achieve good yields.

Conservation tillage is an approach to land preparation that reduces soil disturbance at the planting time and so avoids turning the soil and drying it out unnecessarily. Residues left on the soil surface also conserve soil water and increase the organic matter in the soil, which



*Smallholders who live in the tropical drylands are unable to escape from two fundamental realities: they live in a dry place and their rainfall is unreliable*

in turn improves soil structure, infiltration and water retention. Reduced tillage also significantly reduces the power needed for cultivations at a time when power on the farm is at a premium. But it does create problems of establishing crops and controlling weeds. Wealthier farmers can solve such problems by using higher levels of seeding to compensate for poor crop establishment and a combination of herbicides and in-season tillage techniques to get rid of the weeds. But these options are not available to poorer farmers. They do not have the resources to buy the extra seed and herbicides and may not have the resources for mechanical weeding.

### IN ZIMBABWE

In Zimbabwe over 80% of farmers live in the tropical drylands where they have small land holdings and farm infertile sandy soils. Although the wet season lasts from October to

April, rainfall is unreliable, particularly at the start of the rainy season and there can be mid-season dry spells in January and February. Since 1980 there have been seven bad droughts that have dramatically reduced livestock numbers and weakened what remains. Farmers rely on animals for ploughing and the peak demand for this comes early in the wet season when animals are at their weakest. Those farmers without animals must either till and plant by hand or wait until animals become available after others have finished their ploughing. They then can either hire the animals or barter their labour in exchange. The outcome is usually late planting with resulting low yields. Reduced tillage would help to solve this problem but how can this be introduced and what about crop establishment and the weeds?

Recent work by Silsoe Research Institute in UK and the Department of Research and Specialist Services in Zimbabwe has focussed on this problem. Experimental work began after consultations with farmers about their soil and water conservation problems and methods of cultivation, which best fitted their circumstances. A Participatory Rural Appraisal was conducted among the local farming community and this resulted in an on-farm research programme run jointly by farmers, researchers and extension staff.

#### **CROP ESTABLISHMENT AND WEEDING**

All the farmers use hybrid maize seed and this is often the only cash expenditure they incur.



The importance of good germination is therefore of vital importance to avoid the cost of additional seed for gap-filling and replanting. Three methods of cultivation were tested: traditional hand planting; use of 'Rip lines' - a 25cm deep planting slot cut using an animal drawn tine and opening up furrows with a mouldboard plough and covering seeds with hand hoes or with feet. Weeding options tried included hand weeding with hoes; the use of ox drawn cultivators working between the crop rows and using the mouldboard plough as a weeder to turn the soil and cover the weeds.

Results over four seasons of on-farm trials



showed that reduced tillage methods can be used successfully without any loss of yield when compared with more traditional cultivation practices.

This demonstrated the benefits of reduced tillage as a means of saving on farm power demand. When compared with hand planting methods, reduced tillage produced maize yield increases of between 20% and 300%. Weeding practices did not have any significant effect on overall grain yield. But hand planted plots were observed to be much weedier and when these were not cleared properly this did contribute to the recorded low yields.

Wealthier farmers usually need little encouragement to take up such advantageous practices but poorer farmers have fewer options open to them. Rip lines do mean more labour resources for hand weeding soon after crop emergence and as this is considered to be women's work it can increase their workload. At two places where trials were undertaken, the use of draught animals attracted the attention of the men but other labour intensive technologies were left more to the women.

This work has made it clear to everyone, farmers, extension staff and researchers, that

there was not one set of rules that everyone should follow and the most appropriate techniques depended on the physical, social and economic circumstances of each farm. The use of Rip lines, for example, was taken up readily, particularly by those who could afford to buy the new tools. But as expected this increased the weed infestation on some farms, and so additional resources were needed to cope with this later in the season.

One of the important outcomes of the work has been that farmers are now beginning to experiment for themselves. Many are now conducting their own trials to see what techniques work best for them. This involves putting two options side by side in the same field so that soil and water conditions are the same and so any differences arising from the different techniques are self-evident. Simple budgeting procedures have been developed and tested so that farmers can assess the economic value of new farming practices for comparison with their more traditional methods.

#### **PREDICTIVE TECHNIQUES**

Because of the complexity of the different farming situations, modelling may offer a way of speeding up the process of evaluating options rather than waiting several seasons for field trials to be carried out. Most crop models to date have failed to relate crop responses to management interventions but attempts were made to modify the PARCH-THIRST crop growth model, originally developed at Newcastle University, to include a weed management routine, which simulates the effect of weed competition for soil water on crop performance. Results so far are encouraging researchers to continue the development of this approach.

#### **WIDER OUTCOMES**

The shared nature of the research experience has encouraged the formation of Farmer

Groups so that the process of cooperation and development of new ideas can continue.

Researchers too have shown an increased willingness to move their research off the stations and onto the farms and so now work more directly with farmers. A more regional spin off from the research has been the establishment of a new network – Africa Conservation Tillage Network particularly for the countries of southern Africa.

*Reduced tillage methods reduce the farm power needs without loss of yield. But it means more weeding which can increase women's workload*

But the challenge of providing farming systems which truly benefit the poor still remains. The technology is there and proven but if farmers cannot get timely access to animal power for cultivation and weed control or reap the benefit of herbicide use then the low yields and the weeding and the drudgery this creates, particularly for women, will continue. Research beyond the technological issues is needed to develop ways in which these benefits can be used to improve livelihoods.

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