

Three ways to reduce soil erosion

Recommendations
from the loess
plateau in Shaanxi
Province, China

Achieving long-term sustainable rehabilitation by using the
DESIRE methodology to control soil erosion of apple orchards
on the Loess Plateau



Wang Fei, 2009

Photo 1: A very deep gully resulting from soil erosion in Ansai County

***“It is urgent to
control soil
erosion and
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generation”***

On the Loess Plateau soil erosion is a very severe problem. The planting of apple orchards has been greatly encouraged in the vicinity of Yan'an City (Shaanxi Province), the latest promotion was in 2005, because of a good, productive soil quality and high economic returns. For many reasons, the new apple trees are mainly planted on the hill slopes. The current policy pays insufficient attention to soil and water conservation, so that soil erosion is increased and in the long term this land use is not sustainable. It is urgent to control soil erosion, reduce runoff generation and conserve the soil. Research from the DESIRE project suggests a new agricultural policy regarding the development of apple orchards on the slopes. New measures should be implemented in time to improve both soil conditions and the fruit yield.

This brief discusses the soil erosion issues and makes three recommendations for decision-makers and land use planners in Shaanxi Province.



Wang Fei, 2008

Photo 2: Bare soil between the trees of the apple orchards on the hills of Ansai County



Wang Fei, 2009

Photo 3: Apple orchards planted on steep hillsides in Baota County

Context and importance of the study

The Loess Plateau region is well known for its deep loess deposits and serious soil erosion. The Yan River is a primary branch of the Yellow River, cutting through the Plateau. The climate and soils in the middle and lower reaches of the Yan River are suitable for apple orchards. The profit from apple planting is much higher than from other crops, both quality and yield of the apples are good.

Based on the profitability, the provincial and local governments of Yan'an City in Shaanxi Province planned to enlarge the planting area of apple trees to the northern hills and higher uplands, to improve the income of local farmers. The fertile alluvial lands along the rivers are very limited in area, and the soil quality on the widely available slopes is much better than the lands below the check dam, with higher soil moisture. Apart from some apple trees planted on terraces, most trees are planted directly on slopes. The apple tree can survive and grow even on very steep ones (see photographs above). However, the resulting soil erosion especially from young orchards planted on the bare slopes is very severe, and results from the DESIRE research show that they could account for more than 10 thousand tonnes annually on hills with a gradient of around 20 degrees.



N. Geeson, 2009

Apple orchards provide good profits, but at the expense of soil erosion

Severe erosion may remove and damage the soil beyond repair (as is shown by the deep gully of Photo 1) but this is the long term outcome. In the short term soil erosion may be less of a problem in the orchards themselves, but still be clearly problematic downstream in the river basin, where the muddy waters are full of transported sediment. Meanwhile the speed of development of the apple orchards on the slopes intensifies. The need for intervention to reduce this risk is urgent.

There are some measures to reduce erosion for some orchards, such as terraces and water pits around trees. However, this is not enough, because the evaporation from the soil surface is high as the crown coverage of apple trees is only about 25% to 30% due to the shortage of water resources, and large areas of the apple orchards remain on the bare and vulnerable loess slopes without any soil conservation measures at all. By tradition, some of the local farmers remove the grass around the trees (Photo 2) to reduce its consumption of water and nutrients and improve the growth of the apple trees. Many people also think the loess layer is thick enough to keep soil fertility even with erosion, which is a misunderstanding for the long term.



Photo 4: The muddy, sediment-laden flow of the Yan River, Ansai County

“In the short run the negative effects are only felt downstream in the river basin”

So why are there not more soil and water conservation practices being used on the slopes? Relative labour shortages and the need to make a living result in a focus on tree planting and maintenance rather than soil and water conservation. The wage for a part-time job in the town or city is simply much greater.

DESIRE methodology



The DESIRE study team has researched and monitored this area. They have looked at impacts of different soil and water conservation practices and land use on the natural resources, the benefits of selected practices, and assessed the differences between them with the local farmers.

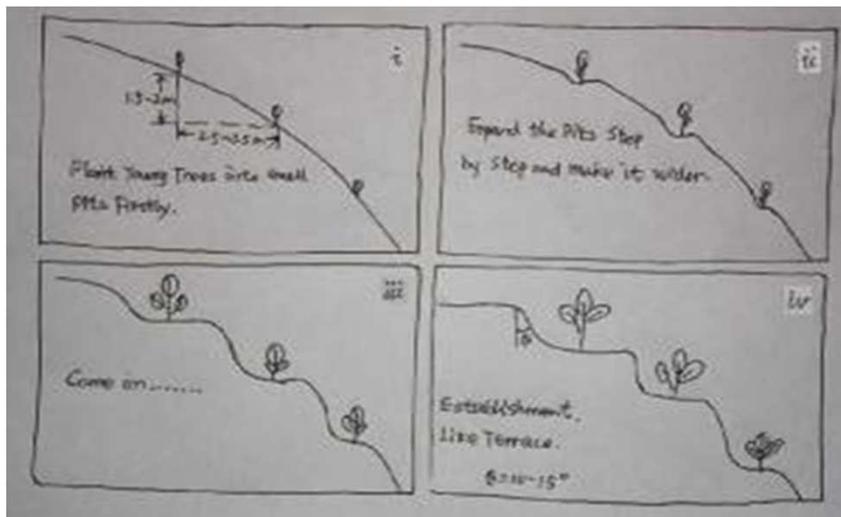
The research has been carried out according to the DESIRE methodology of combining field survey with multi-stakeholder workshops in which local farmers, village heads, local experts, administrative bureaus of Ansa County and scientists made decisions and suggestions for improved land management together.



This method differs from the traditional research projects. Here all stakeholders have the opportunity to bring forward ideas and suggestions for analysis and testing, instead of an expert or researcher telling the other stakeholders what is needed and how it should be implemented. This methodology resulted in agreement on three urgent actions to be taken by policy makers. In order to halt the progressive erosion in the apple orchards, maintain land and soil condition and make the economic return of the trees sustainable in the long run, a new policy is needed.

Current management practices

The present policies pay particular attention to the management of the trees themselves, such as prevention of hail damage, plant diseases and prevention of insect pests, - or small irrigation systems using rainfall collection via water storage cisterns. This is good, but the soil and water conservation needs more attention. If we match economic needs and possible interventions, some technologies tested by DESIRE are good options: such as mulching, an increasing year-after-year terracing method (a local soil and water conservation practice to build terraces up, phased after planting), and grass barrier belts. These measures could be implemented most successfully with the support of government initiatives.



Terracing can be very labour intensive, but if it is done gradually, with a little more dug out year-after-year, it is achieved more easily, and is a very effective measure to reduce soil erosion

By improving the awareness of local farmers, the policy should stimulate farmers to spend more time and labour on soil and water conservation measures, even if there is limited financial support.



Photo 5: Apple orchards on erosion-prone hills: without soil conservation practices (upper slope) and on the year-after-year terraced land (lower slope)

Practical technologies can be matched to an economically sustainable future

Policy recommendations

The effects of erosion appear to be slow on-site as perceived by the farmers, but are in fact high off-site, where lower reaches of the Yan'an River carry a heavy load of the eroded sediment. Since labour and time are in short supply, and orchard farmers don't feel direct short-term benefits from erosion prevention, it is urged that the government should provide incentives for farmers to invest in soil and water conservation on their lands. Such investments would prevent severe erosion damage downstream in the short term, and improve both soil conditions and the fruit yield upstream in the longer term.

Such a policy should cover three components or actions, to be implemented as a package in order to prevent further degradation and economic loss:

- ❑ Actions to improve the awareness of soil and water conservation need to be communicated and initiated with the full range of stakeholders, from local farmers to administrative managers;
- ❑ The soil and water conservation practices should be planned, designed and implemented at the same time as planting new trees on the slopes;
- ❑ Financial subsidies could be paid to the households as an incentive to finish and maintain the soil and water conservation practices that have resulted from the DESIRE participatory research.



There are **three land management technologies** that have proved successful and practical for these apple orchards:

1. Terraces should be built for apple orchards on hill slopes. This can be done with a local form of “year-after-year terracing”;
2. For the new areas to be planted, mulching using residues of crops is necessary to protect the soil structure, and prevent soil erosion and excess evaporation of water;
3. Grass should be kept around the trees or in belts in the apple orchards on steep hills as a barrier to run-off and erosion.

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