SAFE-World Project/Initiative Summary

Country: China

Project / Initiative Title: East Gansu Sustainable Agricultural Techniques for effective Use of rainfall Resources
1991

Scale: Regional | Nos. farmers: 100,000 households | Hectares: 70,000 ha

Agro-Ecological Zone: IV

Improvement types

1x	2	3	4x	5x	6	7	8	9

Success and Limits to spread

Success	Limits
1c	1b, 5b, 6a

A. Key Impacts

A1 – Productivity

	Before / Without	After / With	% change
Winter wheat	3000 kg / ha	4200 kg / ha	40
Spring maize	6000 kg /ha	8300 kg / ha	38

A2 – Impacts on natural capital

Due to application of improved rainwater harvesting methods and water-saving irrigation systems, much runoff on roads and at farmyards was collected and stored in water cellar to irrigate cash crops and drink animals and people, water and soil erosion was reduced greatly. Advanced methods of plastic film mulching on farmland have conserved much rainwater into soil bank and reduced evaporation of whole crop year production, and water use efficiency has increased significantly.

A3 – Impacts on local community (social capital)

Under traditional systems of production responsibility, households always work by themselves, farmer's groups were scarce, and most of production activities were done by man. Since the project carrying out of 1991, united Agricultural production activities in farmers' community / society increased and farmers' mutual aid groups of resource management went up. Households work in coordination in the process of water cellar construction, and share drip irrigation equipment. Much more women took part in activities of fruit and vegetable management and feeding animals

A4 – Impacts on households and individuals (human capital)

Many farmers have benefited from the improved crop varieties and water-saving equipment. Poverty was eliminated, and peoples' living standard in rural villages is improving

A5 – Key changes in farm / regional system

Changes in input: With the high population base and the rapid increase of population in China, the food pressures become more and more serious than other countries. Thus, the unique aim of dryland agriculture production is to increase grain output, fertilizers and pesticides application were inevitable, but it has not reached limits for damaging the environment or harming the health of farmers and consumers because the amount of non-renewable input is lower. With the increasing of people's living standard, we must pay great attention to these non-renewable inputs so as to guarantee food security supply.

Change in local/regional security: Grain output and food per capita in the extending and demonstration sites have increased greatly because of improved crops varieties, runoff harvesting and water-saving irrigation, and fertilizers and pesticide use. The number of households without grain-surplus has reduced and most farmers have grain-surplus in the whole year. Households can feed themselves well. But it is not enough for only achieving food security in quantity. Consumers increasingly seek high quality and healthy foods. Food security is absolutely essential. Our research on agriculture, foods, and the quality of life must contribute to improving the quality, safety, and nutritional value of food products.

Inputs mainly come from government grants of alleviating poverty and the project funds and funds raised by local government and
farmers.

B. Types of Sustainable Agriculture Improvements

Type 1: Better use of available renewable natural capital
Type 2: Intensification of single sub-component of farm system
Type 3: Diversify by adding new productive natural capital and regenerative components
Type 4: Better use of non-renewable inputs and technologies
Type 5: Social and participatory processes leading to group action for making better use of natural capital
Type 6: Human capital building through training-learning programmes
Type 7: Access to Finance
Type 8: Add value by processing to reduce losses and increase returns
Type 9: Add value by direct or organised marketing of produce to consumers

	Yes / No	Narrative
Type 1	x	?? sustainable agriculture technologies for high efficient and benefit use of rainfall were developed and demonstrated. Key contexts included mainly techniques for runoff collection, construction of the stored water tanks, devices for lifting and conveying water, techniques for agriculture use of the harvested water with high efficiency, farm land microcatchment water conserving with film mulching in rainy seasons of Jun to Sept. ?? ammonia-treated wheat straw and silage corn stems were developed as forage. By using ammonia-treated straw and silage stem as forage to feed cattle, the gross weight of cattle per day increased by 42.07% and 25.60% within 90 days,

		respectively; ?? techniques for prolonging food chain and the recycling of animal excrements were put forward in the demonstration site to increase the use efficiency of potential material and energy. The pattern of chicken-pig-methane generating pit integrated feed additive was organizedand implemented in households. The results showed thatthe return of fodder was increased by 15.32-53.32 by using fresh chicken excrements to feed pigs.
Type 2		
Type 3		
Type 4	x	implanting Gibberellin(GA), which is a growth-regulating agent, under the neck skin of the beef cattle is an economic and effective way for rapid fattening. The gross weight of cattle was 80% higher than that without GA.
Type 5	x	Many group organizations and institutional partnerships and new techniques training classes were developed and adopted in order to speed up demonstration and extension. First, we set up new techniques model of experiment and demonstration in the farmers' field and our experimental field according to technical norms, let farmers practice in person improved techniques and make them receive economic benefits. Second, we report our good results and advanced model to local and provincial government, organized local township leaders and farmer representatives to visit on-the-spot experimental and model fields. Improved techniques and advanced models were extended by government organizations and action in local and regional level. In the demonstration sites, technical teams including village leaders and selected households together for setting up demonstration examples of new techniques, and township technical training centers and agriculture development union organisating by township leader and our researchers were established.
Type 6		
Type 7		
Type 8		
Type 9		

C. Key Lessons: Success, Spread and Constraints

C1 – Key Lessons Learned

The study of sustainable agriculture in dryland areas is time-consuming and hard work which deal with multi-disciplines and many industry sectors. Nothing can be done and fewer results can be obtained only by a short time. A complete problem of sustainable agriculture was not solved by single-sided research. Changes of government policy and personal alteration may great affect the project implementation. The researchers will lose confidence of studing agriculture new techniques because of the limited project funds.

Based on the results of the research, demonstration and extension, the following advantages should be considerably affirmed: (1) dryland agriculture production should be developed by

runoff harvesting in water cellar and recycling of stored water for critical irrigation. Water-harvesting systems and water cellar should form an integral part of dryland agriculture to stabilize crop yields and to build up the confidence of farmers in dryland agriculture; (2) finite runoff water must be given priority to vegetable in greenhouses vegetable, farmers' orchards, and high yield and excellent quality crops so as to improve WUE effectively; (3) techniques for water-saving irrigation must be combined with the plastic mulching cultivation so as to reduce soil water evaporation loses; (4) the feasibility methods such as hole irrigation, drip irrigation, subsoil irrigation, and super-sheet irrigation etc.should be adopted at different crops. On the other hand, construction techniques for artificial catchment area, application and selection of chemical materials for water harvesting, techniques of field microcatchment water harvesting and conserving for increasing fallow efficiency in rainy seasons, and substitute materials for the water cellar forming still need to be further studied and solved.

C2 – Aspects of local/national context contributing to success

According to the combined report submitted in 1990, drylands in Northwest China are now a source of 24% the country's total crop production. By the year 2000, it is expected that 30% of the food for her growing population may come from drylands. According to the Chinese Agricultural Altas(1992), most of the dryland area in Northwest China mainly involves 16 provinces and cities and autonomous regions with 51 million ha land (accounting for 52% of that of the whole country) having an annual rainfall of 300-600 mm with 50-60% rainfall during the months of June, July, and August. There is a great variation of rainfall from year to year and drought damage occurs frequently. There is shortage of surface water and subsurface water. Annual nutrients' losses in soil are equal to the total amounts of annual fertilizer applied. Total N in the soil of farmland is 0.05%. Organic matter content in soil is less than 1%. Most of the regions achieve food self-sufficiency with difficulties, and also the parts of regions depend on national relief grains. The crops' yield quite low and unstable, experiments have shown that there is considerable potential. In the case of such unfavorable conditions, during China's Eighth and Nighth Five-year National Development Plan (1991-1995), the Chinese government-sponsored several key projects so as to reduce water and soil erosion, better soil fertility of farmlands, and achieve food self-sufficiency as well as realize sustainable development of dryland agriculture in Northwest China. Our study was part of these projects.

C3 – Limitations preventing spread

Main factor limiting the project from being more successful as follows: (1) shortages of the project funds make many new techniques studied and developed with difficult. (2)poor farmers realized advantages and benefits of new techniques, but they felt powerless and frustrated using these improved techniques because the farmer has no money to purchase advanced techniques and these techniques are expensive. (3) dryland agriculture production is still a risk industry which is affected greatly by environment. (4)there is an undeveloped rural market, farmers' products were transferred into commodities in difficulties. The contents of the project dispatched with the regulation of economic markets

C4 – Policy issues

Unawareness and shortage of knowledge to new technologies, less participating activities of government and farmers, not enough inputs, undeveloped market, and bad technologies spread organization are preventing the scaling up process.

C5 – Scaling-up

Extension and demonstration of new techniques are time consuming and painstaking because technology diffusion process involves showing farmers that technology is doable, adaptable to their environment, profitable, socially acceptable, and in their best interests over the short and long-term, and because technology adoption deals with the extent to which the farmer uses the technology, has adapted it to his conditions and reality, derives benefits, and is willing to continue using it in the future as long as it is still performing well. Diffusion and adoption are two separate stages in the process of technology development and transfer. This means that an innovation has proven to be adapted to the environment and to farmers' needs, and is profitable in terms of food security and income generation. An innovation is adopted when farmers are ready to invest for its continuous use. One of the processes of new technical training was to create new awareness and knowledge and idea for techniques innovation among farmers, and extension agents. The aim of the transfer of technologies to the farmers is to improve or at least strengthen the existing system, while achieving acceptance by farmers and government officials. Thus, Government agencies and techniques training centers at local and regional level are very important for transferring technologies to the farmers to promote sustained agricultural production in large scales.
At the same time, some factors of affecting techniques spread regarded as important are a well-defined market, the sufficient outlet to physical inputs, farmers' participation and organization, provision of extension service, guaranteed quotas, and local government supports to technologies. Above these factors should be stressed further

D. Contact Point for Project/Initiative

Contact person: Fan Tinglu
Address/Email: Dryland Farming Institute, Gansu Academy of Agricultural Sciences, Lanzhou, Gansu, P R China. Dryland@LZ.GS.CNINFO.NET

E. Project Narrative

China: East Gansu Sustainable Agricultural Techniques for Effective Use of Rainfall Resources Project

The East Gansu region is part of the 51 million ha dryland area in the Northwest of China. Conditions for agriculture are challenging: annual rainfall varies greatly, drought damage occurs frequently, there is a shortage of both surface and ground water, nutrient losses from the soil are high, and soil organic matter (OM) content is less than 1%. Food self-sufficiency is difficult to achieve with crop yields being low and unstable, and parts of the area are heavily reliant on national grain relief.

The Chinese government sponsored several key projects concerned with developing sustainable agriculture in the drylands of Northwestern China as part of the Ninth Five-year National Development Plan aimed at achieving food security and self-sufficiency, reducing soil and water erosion and increasing the soil fertility of farmland. The Sustainable Agricultural techniques for effective use of rainfall resource in East Gansu project, initiated by the Dryland Farming Institute of the Gansu Academy of Agriculture in 1991, is one such project.

The East Gansu project developed sustainable technologies to promote more efficient use of

rainfall through run-off collection techniques, water storage tank construction, devices for lifting and conveying water, microcatchment water conservation with film mulching, and multiuse crop products and bi-products for livestock.

The demonstration and extension of these techniques started both with experimental field sites and village fields, and as results were reported back to local and provincial governments, township leaders and farmer representatives visited the sites and became involved. Technical teams of village leaders, local farmers and researchers demonstrated the techniques in township technical training centres and an Agricultural Development Union was established.

The number of farm households adopting these sustainable agriculture techniques is now 100,000 on an area of some 70,000 ha of dryland. Cereal yields have increased substantially - wheat by 40% (from 3 to 4.2 t/ha), and spring maize by 38% (from 6 to 8.3 t/ha). There is greater availability of water for both irrigation and drinking water for people and animals. Other benefits include reduced soil erosion, increased water use efficiency, decreased pesticide and fertilizer use, increased social capital through formation of farmers' mutual aid groups (households work together on constructing water conservation technologies, and share equipment), and women now play a major part in fruit and vegetable management and livestock rearing.