THE DEVELOPMENT OF SUSTAINABLE CROPPING SYSTEMS ON RED SOILS IN THE HIGHLANDS OF SOUTH CHINA

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ABSTRACT

Soil conservation on the highland red soils of Southern China is essential for sustainable agro-environmental development. The effectiveness of soil conservation treatments developed in runoff plots was investigated in farmer-managed plots on a natural catchment. This was achieved by the development and scientific evaluation of modified and novel cropping practices in a representative highland catchment in Yunnan Province, China. Wang Jia Catchment covers 40.1 hectares near Kedu, in Xundian County, northeast Yunnan (25°28' N, 102°53' E). The initial project consisted of an evaluation of the effects of modified cropping practices on maize productivity and soil properties. This programme was extended to investigate ways of increasing the productivity of maize, wheat and soybean on fragile slopes in a sustainable and environmentally-friendly way. The approach incorporates modified and novel agronomic and soil conservation measures, with the evaluation of their agricultural, environmental and socio-economic impacts using multidisciplinary approaches. This European Union funded project involved an international research team from Belgium, China, Ireland, Thailand and the U.K. Five co-ordinated work packages were implemented. Involving:

(1) Background agricultural and environmental assessment of Wang Jia Catchment.
(2) Implementation and evaluation of modified and novel cropping systems for wheat, maize and soybean in the catchment.
(3) Cost-benefit analyses of the socio-economic impacts of the changed cropping practices, assessing returns for stakeholders, poverty alleviation, income augmentation and rural development.
(4) Comparative scientific evaluation of the cropping techniques in the highlands of northern Thailand.
(5) Dissemination of project outcomes and establishment of training programmes for best practice in highland rural development.

Key words: China, Plastic mulch, Straw mulch, Yunnan.
1. INTRODUCTION

Agro-environmental systems on red soils in the highlands of South-East Asia are under considerable pressure. Crop yields on sloping land in South China have decreased due to soil erosion and it is possible that in 50-100 years most topsoil will have been removed (Fullen et al., 1998). Rapid industrialization and urbanization, coupled to continuing demands for increased food production, are putting further pressure on land use. This is encouraging agricultural intensification and greater use of these fragile areas. More effective soil conservation is therefore essential for sustainable increases in productivity on red soils on hill slopes.

The outlined project is an integrated and holistic attempt to increase the productivity and sustainability of cropping systems in the highlands of South-East Asia by the SHASEA (Sustainable Highland Agriculture in South-East Asia) Research Team. It involves the participation of scientists from many different disciplines (agriculture, biology, economics, geology, hydrology and soil science), from different West European and Asian countries, working alongside local farmers and their families in South-East Asia. Attention has particularly focused on the effects of cultivation and conservation treatments on crop productivity and soil erosion rates on the subtropical arable red soils of the Upper Yangtze basin in the Central Plateau of Yunnan Province, China.

2. AN INTEGRATED STUDY OF WANG JIA CATCHMENT: PHASE 1

To contribute to the development of appropriate soil conservation strategies, a runoff plot study at Yunnan Agricultural University (Lat. 25°08' N, Long. 102°45' E, elevation 1930 m) evaluated the effectiveness of various soil conservation measures. Various cropping treatments were applied to maize (Zea mays) grown in 30 erosion plots at three different slope angles. A treatment programme has been maintained for each cropping season since 1993. Throughout each season, measurements were taken of runoff and erosion rates, crop yield and yield components and soil thermal and hydrological regimes. Results strongly suggest the benefits of straw mulch and contour cultivation in conserving soil, water and nutrients (Fullen et al., 1997, 1999; Barton 1999; Milne, 2001; Milne et al., this volume; AN Tongxin, 2002).

The team recognized that further progress required full evaluation of the applicability of techniques developed in plot studies to actual field conditions. The research team achieved this by the development and scientific evaluation of modified and novel cropping practices in a representative highland catchment in north-east Yunnan, 60 km north-east from Kunming. The selected catchment, Wang