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MANAGEMENT REPORT

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“Rejuvenation of Forests with Fodder Trees and Shrubs to Sustain Goat Production in the Hills of Nepal”

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1. Scientific Summary

Approximately 60% of Nepal's 23.2 million people live in small holder villages, each having up to 70 households. In the hill regions, subsistence farming is practiced by the cultivation of mixed grain crops on terraced hill slopes and rice on low land paddy fields and the raising of buffaloes for milk products. Individual households own, on the average, up to a hectare of land, one or two buffaloes and up to six goats. Cash income is derived from the sale of goats and of surplus grains and from work opportunities in and outside the village. Each village usually has regulated access to a forest and/or a degraded forest area that is administrated by an elected village committee. The main resource of animal feed, in addition to on-farm crop residues, are from forest foliage and herbage which can be gathered from forests but not browsed or grazed. The agricultural production potential of households is limited by their small land holdings and the regulated availability and poor nutritive value of the animal feed resources.

This project's objective is to rejuvenate communal-forest and grassland areas that had been either denuded of lower branches or degraded to dwarf-shrub and/or barren land by over-utilization and poor management by small holders. The project site is within the Kattel-dada village boundaries near the Ghorkha Bazaar municipality in the Ghorkha district, in the Mid Hill ecological zone of Nepal. It endeavors to increase animal production at a sustainable level by improving the availability and quality of feed for both goats and buffaloes. To achieve the objective, it is planned to:

1. Determine the ease of establishment, development, growth rate and regrowth after harvesting of promising indigenous fodder trees and shrubs when between row cultivated with annual legume crops and grasses to maintain soil fertility.
2. Evaluate the nutritional value of selected trees, shrubs, legumes and grasses to test their ability to sustain improved goat production.
3. Plant out species that meet the above criteria in both degraded communal-areas and in and around individual farms.
4. Develop a management strategy that will prevent further degradation of existing forests, new plantations and rejuvenated grasslands.
5. Use existing farms as pilot farms, within a hill country village complex, that has access to both partially degraded communal forest and barren dwarf-shrub areas, for carrying out the above methodologies and strategies.

Within and between tree row cultivation can be carried out only on privately owned land and on community land officially designated as marginal degraded areas unsuited for reforestation. Strict government regulations forbids any cultivation practices within community forests, other than the planting of fodder tree species.

2. Scientific Issues

In Nepal

The Nepalese investigators made several field visits to Kattel-dada to discuss the planned crop and goat studies with farmers. They spoke to the various committees to identify farmers willing to participate in the project. In particular, studies were organized for households to carry out goat feeding studies with fodder tree foliage with and without on-site supplementation with herbaceous species. Plans are also being discussed with the village forest committee to plant out promising trees in their communal forest and stylo in marginal degraded land areas.

In addition, discussions were held with scientists at the Goat Research Center at Bandipur for the purchase of goats. Liaison support for the project from the Departments of Livestock, Crop and Forestry Services, whose district headquarters are at Gorkha Bazaar, was recruited. The Nepalese investigators also visited nearby forestry nurseries to verify the availability of seedlings for the project.

Pigeon peas on upland terraces and stylo on marginal land were sown; the marginal land was allocated by the village crop committee. Samples of fodder trees growing in Kattel-dada were collected; namely *Gruga pinata*, *Premna integrifolia*, *Ficus cunia* and *Ficus lacor*. These samples were analysed for chemical composition in Nepal and duplicate samples were sent to Israel for *in vitro* metabolizable energy determination according to the following basic procedures:

Samples were oven-dried to constant mass at 50°C. Sub-samples to determine dry matter content were oven dried to 100°C. Nitrogen (N) content was determined by the Kjeldahl method and ash content by burning at 550°C (AOAC 1990). Crude protein was calculated as 6.25 X N. Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined as described by Goering and Van Soest (1970). The difference between NDF and ADF was designated as hemicellulose, and between ADF and ADL as cellulose.

The security situation (the danger of terrorist attacks from Mao rebels) and imposed curfews has interfered with travel for government workers and with the carrying out the project in general.

In Israel

Foliage samples from Nepal were sent for analysis of secondary compounds, such as tannins, and duplicate samples were analysed for *in vitro* metabolizable energy yield.

A graduate student is carrying out a biochemical study of fodder tree and shrub foliage using the advanced Menke Gas Test for determining *in vitro* metabolizable energy content of feeds. He is using the procedure with local tree and shrub foliage and calibrating the *in vitro* results with concurrent results from *in vivo* trials. He is using the following procedure:

Metabolizable energy (ME) of the samples is estimated *in vitro* using the Hohenheimer Gas Test. In this method the gas produced in anaerobic fermentation of substrate is used to predict the ME yield. Rumen liquor and particulate matter are collected before morning feeding from two goats and two sheep fed a roughage diet; the liquor is homogenized, strained and filtered through glass wool. Incubation media is prepared as described by Menke *et al.* (1979. *Journal of Agricultural Science, Cambridge* 93: 217-222). Samples, each 200 mg dry matter, are incubated in triplicate in 100 ml calibrated glass syringes in which 30 ml of the incubation media is added. The glassware is kept at 39°C and flushed with CO₂ before use and the mixture then stirred under CO₂ at 39°C. Gas production, as determined by piston movement, is measured over 24 hours after correcting for gas production due to rumen fluid alone. Metabolizable energy (ME; kJ/g dry matter) is then calculated from the gas produced (GP; ml from 200 g dry matter/24 h) and crude protein (XP; g/kg dry matter) as:

$$ME = 2.20 + 0.136 GP + XP$$

In addition, two types of questionnaires were prepared for use at Kattel-dada; one for providing detailed information of the agricultural and organizational situation at the village level and the other for details of individual households. It is hoped to use these questionnaires at other nearby villages in the Ghorkha district for comparative purposes and possible application of results to other villages within the district.

3. Collaboration

There has been continual correspondence between the Israeli and Nepalese investigators in order to coordinate activities in their respective countries. These activities have been both on the organizational and scientific level. In addition, Professor Degen and Mr. Benjamin were in Nepal for from January 23 to February 8, 2003. The objectives of their visit was: 1) to have discussions with Nepal Agricultural researchers working in animal and crop husbandry, forestry and soil science; 2) to visit the Kattel-dada village where the on-site studies are being done; 3) to have discussions with field officers of the Departments of Livestock, Crop and Forestry Services whose district headquarters are at Gorkha Bazaar, and 4) to interview farmers who are willing to participate in the on-farm

goat nutrition studies using fodder tree foliage, stored crop byproducts and newly introduced legume crops such as pigeon peas. A prepared questionnaire was used.

4. Managerial Issues

This project was officially accepted and funded in August, 2001. Dr. Shambu Panday and Dr. Laxman Sherchand, the Nepalis principal investigators, and Mr. Netra Osti, the field officer, have effectively coordinated the project's activities with the farmers at Kattel-dada. They have managed to illicit the active help of the various Department of Agriculture field officers stationed at Gorkha Bazaar in order to liaison between the project's investigators stationed at Kathmandu and the farmers at Kattel-dada. The communication and traveling problems during the period under review, were very difficult and dangerous due to the continual threat of terrorist attacks in Nepal and in particular, the Gorkha district. This situation restricted the carrying out of some of the project's planned program. Fortunately, a cease-fire was proclaimed between the Government and the terrorists at the end of January this year. It is hoped that the cease-fire will become permanent so that the project's program can be fully implemented during 2003.

5. Reallocation of Budget Items

No requests have been submitted by the participating institutions.

6. Special Concerns

None have arisen to date.