GRASSLAND DEVELOPMENT BY EROSION CONTROL ON HILL SLOPE USING MULTI FUNCTION FILTER AND VEGETATION

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ABSTRACT
Soil erosion by water is a major soil degradation process in the world and constrains of land development for cultivation. Japan is a mountain based country with a large number of volcanos and most of the soils are highly erodible volcanic ash soil. Therefore, soils will erode when rainfall is sufficient. Since 1992 an intensive programme has been undertaken to develop grassland or cropland by controlling soil erosion on hill slopes. Multi function filter (MFF) have been used along with the application of different rooty summer and winter grass seeds to protect surface soil and rapid germination of deep vegetation at four different sites of Miyazaki Prefecture. Within one year of application of MFF it was possible to bring a considerable amount of area under cultivation and slope sliding was nil even though approximately 300 mm of rainfall occurred in a day.

KEYWORDS
Grassland development, soil erosion, slope gradient, multi function filter, vegetation

INTRODUCTION
Given proper soil conservation and management, many areas could be farmed permanently and much more intensively without risking undue soil erosion and deterioration. Well planned soil conservation introduces a better choice of land use, improved farming practices, conservation of soil moisture and other measures designed to increased agricultural production and thus raise the population supporting capacity of the land. FAO (1980) estimated that in order to feed the world in the year 2000 an additional 150 to 200 million ha of new land should be brought into production. Development of farm land plays a vitally important role not only in farm land protection, but also in disaster prevention and ecological control (JIID, 1992). Vegetative cover on the soil is recognized as a major factor affecting soil erosion (Meyer *et al*., 1970; Lattanzi *et al*., 1974). Accelerated erosion is especially threatening in many developing countries where increasing amounts of marginal, steep land are being cultivated (Grosh and Jarrett, 1994). In this study we tried to stabilize the condition of a steep slope of 45° by dense vegetation cover. Vegetation reduces surface runoff by increasing infiltration and roughness of the soil surface and finally reduces soil erosion on hill slopes.

MATERIALS AND METHODS
MFF have been randomly used for stabilization of steep slopes in our land development programme. Another way to express MFF is non woven fabric (NWF) because a large part of the material is short chemical fibres, resembling fibrous rootlets randomly oriented in a mat form. This NWF is made of polyester so its quality does not change, it is very soft to setting to the surface of the soil and its porosity is about 98%. Main functions of this NWF are erosion control and mitigation of climatic environments. Under erosion control it prevents peeling-off of soil particles caused by raindrop impact, reduces surface runoff flow and turbulent flow, and increases percolation rate for its high permeability. It also mitigates scattering of soil particles by wind, reduces evaporation rate and controls temperature changes. NWF has no nutrient value in itself but it helped to promote rapid germination of vegetation seed by immobilization of soil particles and mitigation of climatic stresses.

First of all it is necessary to get the hill slope in plain surface condition by cutting and filling at a certain gradient. In the case of high hills it is advisable to make terraces. After completion of slope surface leveling NWF was placed next to the surface of the soil with vegetation seed at a certain rate, fertilizer may also be used if sloping soil is not fertile enough to grow vegetation. A drainage outlet was constructed at the bottom of the slope to drain runoff flow. Different grass seeds viz. Kentucky 31 fescue, Creeping red fescue, Kentucky blue grass, White clover , Lespedeza bicolor and Lespedeza cuneata were applied at a certain rate as a summer vegetation. As winter vegetation Kentucky 31 fescue, Burmuda grass, Weeping love grass, Lespedeza bicolor were applied. Alfalfa and Oat was not planted for controlling soil erosion because the results are not well documented (Wollenhaupt, 1995).

RESULTS AND DISCUSSION
There were four different hill sites of 576, 820, 1675 and 1320 m^2 of Hae No.1, Hae No.2 Tokya No.2 and Tokya No.3 respectively brought under cultivation in March, 1992. Five years after construction the vegetation in both Hae No. 1 and Hae No. 2 sites is in good condition, slope erosion and slope failure have not been observed and slope has been stable even under the successive heavy rainfall in the summer in 1993. In Tokya No. 2 and Tokya No. 3 there were high erodible soils named Shirasu; soil was exposed and vegetation seeds were gathered in some places, but the slope is still in good condition and no slope failure was recorded although heavy rainfall occurred. Fodder crops and vegetables are growing successfully every year continuously, as shown in Fig. 1. Before development of these four sites, it was not possible to grow any crop on these sites.

Erosion control on hill slopes by using this NWF is now becoming popular in Japan as well as many other countries. This method is more environmentally friendly than masonry works or others. Many countries are suffering from heavy soil loss and unsuitability for farming in more steeply sloping land. Sound soil conservation measures will be increasingly essential for development of these kinds of land on a sustainable basis.

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Figure 1
Steps to control soil erosion on hill slope using multi function filter and vegetation.