Agricultural Applications of North-South Slopes in the Sub-Sahara Regions

The north-south slope design is intended to reduce evapotranspiration (ET) on semiarid terrain and make it suitable for agriculture. The plan is to apply it on unutilized dryland and thus create newly arable land. The second economic benefit besides creating newly arable land is the reduction of ET, retaining rainfall and soil moisture, adding to the economics of the new approach.

North-South Slopes in the Northern Hemisphere above 23 Deg N;
Sun always shines from the south in N. Hemisphere

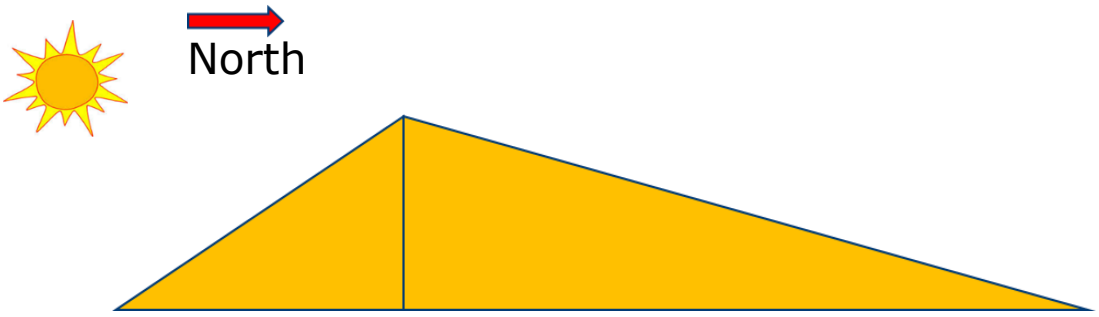

Fig.1: Solar intensity on the northern slope is reduced, leading to a reduction of ET, allowing for cultivation on the moist shaded slope. The slopes are not symmetrical since we want to maximize the area of the cultivated northern slope.

In latitudes above 23 Deg N and below 23 Deg S, the reduction of ET will occur on the northern and southern slopes, respectively. In latitudes between 23 Deg N and 23 Deg S, as in the Sub-Sahara, there is an interesting possibility since there,

the sun shines in the winter from the south and in the summer from the north. Symmetrical slopes have the potential for using one slope in the summer and the second slope in the winter depending on the annual rainfall patterns.

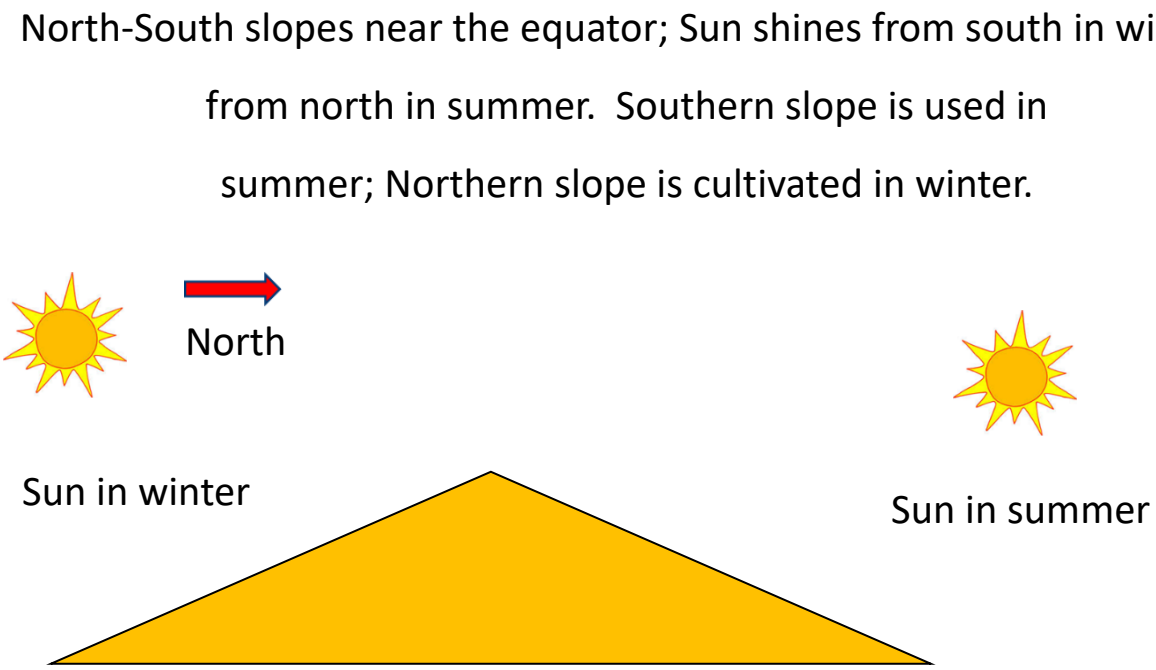

Fig. 2: In the summer the south slope is used; in the winter the northern slope is cultivated.

The concept is geared for cultivation on semiarid land where there is at least 200 mm annual rainfall. However, in some semiarid regions in Africa, it is possible that at one season there is no rain at all, and all or most of the annual rain falls in another season. In this case the slopes will not be symmetrical since we should maximize the area of the cultivated, moist slope.

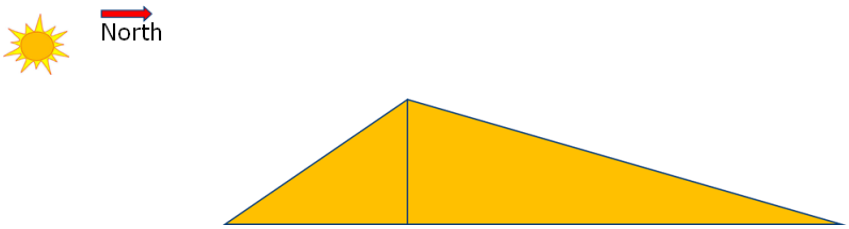

Fig. 3: A region near the equator where no rain falls in the summer. The rain falls in the winter where the northern slope is moist, but solar intensity and ET are reduced on that slope. In this case, the dry southern slope will not be cultivated. The northern slope is longer to maximize the cultivable land.

In this case, we should pay attention to the following example: Assume that at this region the annual rainfall is 200 mm, but all rain falls only in one 6-month season. Since there is no rainfall over the other 6 months, the rainfall during the wet season on the cultivated slope is equivalent to 400 mm, not 200 mm! This possibility will require research on climate and rainfall patterns at the region designated for cultivation.

So far, the concept is geared for ET suppression to allow cultivation on semiarid newly arable land where rainfall is scarce and surface water is not available.

An additional possibility is the following: When water is plentiful due to rainfall or due to irrigation availability, the slopes concept could be used in some seasons not to address ET reduction but to increase solar intensity on the slope facing the sun. Depending on the latitude, sloping angle, and season, the illuminated slope can have solar intensity 6 times that on the shaded slope.

Some high-value crops such beans, eggplants, peppers, beets, cauliflower, broccoli, cucumbers, squash, cantaloupe, watermelon, and tomatoes, to mention a few, thrive under intensive solar and could have plant productivity higher than

on flat terrains and much higher than what is available today.

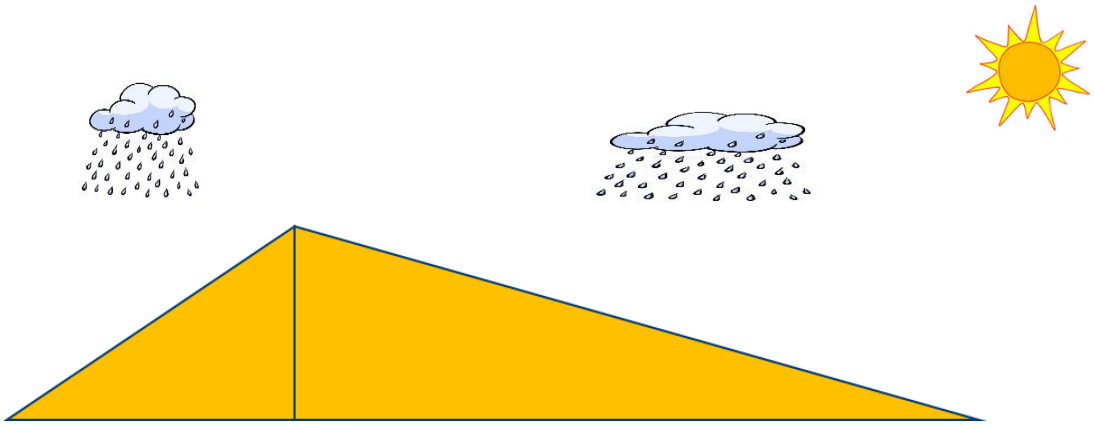

Fig.4: In regions where rainfall and irrigation water are plentiful, the illuminated slope facing the sun could be used for cultivating high-values crops that thrive on solar intensity providing a diversity of food stuff.

In some regions the applications of the illuminated slopes will enable the cultivation of new crops that are not cultivated there at all, providing a diversity of food stuff and making better applications of available agricultural resources. This concept could be applied on existing arable land that has plenty of water and not on semiarid dryland.

To summarize, the north-south slopes concept provides new agronomic modes that could fit a variety of regions, latitudes, and seasons. For now, the proposed pilot development will concentrate on specific slope configuration, rainfall, and crops. During the pilot program, we will explore and develop variations of the basic concept to address implementation in different regions in Africa.

Research on the N-S slopes applications is being discussed now with scientists from Kenya, Tanzania, Botswana and Nigeria.