Geophysical Research Abstracts
Vol. 16, EGU2014-2117, 2014
EGU General Assembly 2014

Evaluation of zigzag furrow irrigation in Andean communities

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It is estimated that the area under irrigation in Bolivia represents 9.7% of the cultivated area, ie 253,100 ha. Traditional surface irrigation is the main system used in Bolivia. Currently, 40,000 ha are irrigated in the La Paz Department. The largest irrigated surface and the areas that produce most food in the Department are located in the eastern and western mountain ranges. However, the region's abrupt terrain makes it impossible to use conventional surface irrigation methods. . As a result, farmers in the inter-Andean valleys have used other surface irrigation methods intensively for hundreds of years like zigzag furrow.

In this study, we conducted field trials in the rural community of Cebollullo of the municipality of Palca of La Paz Department. Cebollullo is located at an altitude of 2,780 m above sea level. Its geographic coordinates are 16°41'90.1"S to 16°43'12"S latitude and 67°52'13"W to 67°59'15"W longitude. The irrigated area is characterized by its steep slopes and zigzag corrugated furrow irrigation method is used. The main objective of this study is to evaluate the performance of zigzag furrow irrigation in this community.

The study plot has an area of 728 m2 and the average slope is 16.46%. For irrigation evaluation, the data of a middle furrow were taken to avoid boundary effects. Irrigation events recorded during the crop development were 21, with irrigation frequency of 2 to 3 days, of which 10 events were evaluated weekly. Due to the low flow rates used for irrigation, the inflow and outflow measurement of the furrows was made volumetrically. These flow measurements were made at five-minute intervals during irrigation. The zigzag corrugated irrigation method uses low flow discharges in order to decrease the rate of irrigation allowing infiltration of required volume by the crops and reducing soil erosion.

Application efficiencies in the study plot ranged between 7.55% and 30.31%, with losses by surface runoff from 45.90% to 85.83% and deep percolation losses of 3.53% at 41,08%. Therefore, improvement of irrigation would suppose to increase the irrigation time, to reduce the inflow or to increase the length of the furrows. However, surface runoff losses are reused in plots located at lower altitudes increasing application efficiency at the community level. The average inflows ranged from 0.026 to 0.236 L/s, with average outflows between 0.022 to 0.184 L/s, thus showing a wide variation in the inflow, mainly due to unforeseen use of irrigation water in plots located upstream belonging to other irrigators, affecting irrigation performance.