



### AGRICULTURE CONSERVATION FOR EXTREME AGRICULTURAL PRACTICES TO MINIMIZE RUNOFF HARVESTING AT GUMUK MICRO CATCHMENT, BOYOLALI REGENCY, CENTRAL JAVA

Most of the farmer in Gumuk Village, Boyolali Regency famous for the cultivation of high value crops such as vegetables, tobacco, rose and fennel. The cultivated land situated at an altitude about 1400 m above sea level which the dominant steep slopes to reach more than 45 % of Merapi Mountain as well as the upper part of upstream of Kali Pusur watershed (Figure 1). The common agricultural practices of local farmer is traditional as well as parallel to the slope planting, low dosage of dung, compost and chemical fertilizer, and only a few farmers who grow roses and the fennel as a vegetative terrace. The consequences are high risk of erosion, land slide, sediment yield and runoff harvesting. The phenomenon will indirectly affect the hydrologic variability such as flash floods in the rainy season, sedimentation of reservoirs and irrigation networks and declining on the recharge rate of aquifers that constitute the main water resource during dry season in the downstream area which is largely a food crop production center of Klaten regency.

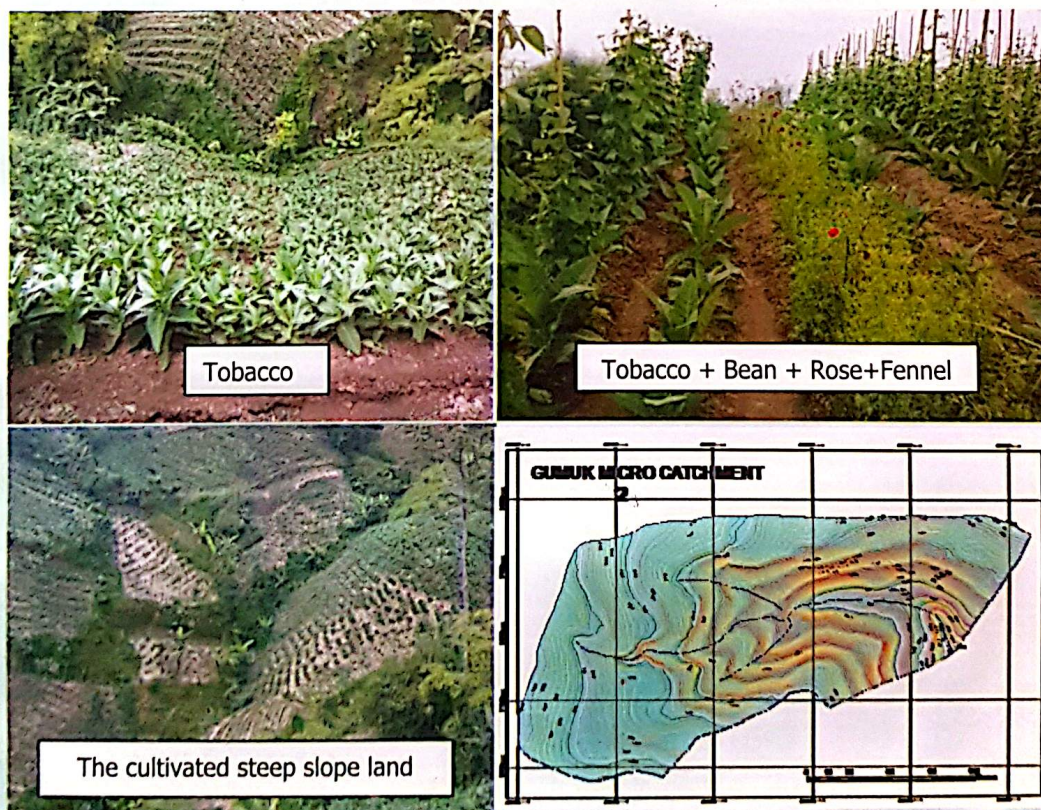


Figure 1: Cropping type, cultivated steep slope land and situation map of Gumuk micro catchment.

Therefore, Indonesian Agroclimate and Hidrology Research Institute (IAHRI), Centre de Coopération Internationale de Recherche Agronomique pour le Développement, France (CIRAD), and Assessment Institute for Agricultural Technology of Yogyakarta take initiative to assess the feasibility of eco friendly agricultural practices in the upper part of the recharge area assumed to be the most effective area through improved water and soil management practices tested upper part of the recharge area. There were three activities approaches i.e: Micro terraces experimented to manage runoff and limit erosion have been tested by farmers on their own initiative; Minimum tillage feasibility, better use of manure, food crop diversification are issues to be tackled according to SMART village approach ; Modeling (Stream model) has allow to underline the necessity to improve water way in order to minimize gully erosion and landslides and the necessity to design and test solutions are summarized in the innovative agriculture conservation technology. The innovative agriculture conservation technology assesment is one part of towards an effective integrated management of Kali Pusur water resources action plan. The introducing technology consist of crop distance, transverse slope planting, number of the ridges and spacing between as well, planting system for each ridges (single row versus double rows), water way and recommended fertilizer dosage comparing with the traditional agriculture practicess. Maize cultivation as a crop trials as well as planted at the end of November 2012 on various slopes (table 1).

Table 1: Parameters of treatments of innovative agriculture conservation comparing with local farmer practices

Parameter	Slope 30%		Slope 42 %		Slope 92 %	
	Farmer	Inovation	Farmer	Inovation	Farmer	Inovation
Slope length (m)	18	18	16	16	17	17
Plot wide (m)	12	12	10	10	6	6
Distance beetwen ridge (m)	-	1,5	-	1,5	-	2
Strip-Ridge distance (m)	-	5	-	4	-	3
Number of ridge in the strip	-	4	-	3	-	2
> Tanaman dalam strip Gulud	-	Mawar	-	Mawar	-	Mawar
Main cultivated crops	maize	maize	maize	maize	maize	maize
Secondary cultivated crops in the ridge	no	rose	no	rose	no	rose
Planting system	single row	double rows	single row	double rows	single row	double rows
Urea fertilizer dosage (kg)	300	300	300	300	300	300
NPK fertilizer dosage (kg)	no	300	no	300	no	300
Water way	yes	yes	yes	yes	yes	yes
Drops structure	no	yes	no	yes	no	yes

The harvesting runoff and sediment were collected by Ching-Ong equipment which is mounted on the bottom corners of each plot treatment, following the slope of the land as well as connected to the water way around the plot treatment (Figure 2).

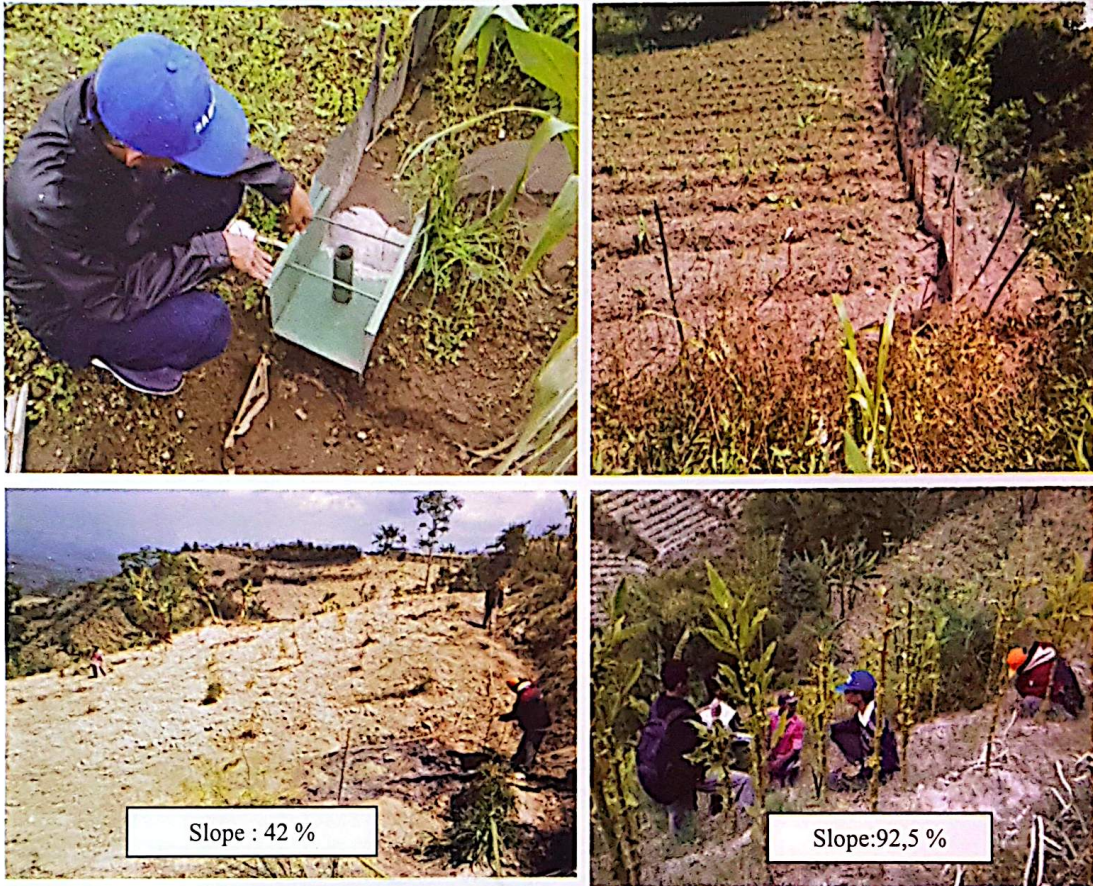


Figure 2. Ching-Ong equipment, water way to collect sediment and runoff harvesting, and treatment plot.

The small rainfall during 15 days after maize planting has not result to produce runoff. The harvesting runoff due to rainfall occurred from the begining of December 2012. The inovative agriculture conservation decrease runoff for all trial slopes comparing with local farmer practicess and reach more than 50 % decreased runoff at 92 % of slope (table 2).

Table 2. Harvesting runoff of the inovative agriculture conservation comparing the local farmer practicess

Parameter	Slope 30%		Slope 42 %		Slope 92 %	
	Farmer	Inovation	Farmer	Inovation	Farmer	Inovation
Runoff (liter/hectare)	28.033,73	22.323,88	7.929,22	6.164,38	12.654,15	6.085,78

Runoff simulation model has also developed in order to get the global description related to the effect of agriculture conservation practicess to the harvesting runoff at small catchment area and to underline the necessity to improve water way in order to minimize gully erosion and landslides and the necessity to design and test solutions are summarized in the innovative agriculture conservation technology. Runoff simulation using the STREAM model developed by Poussin, JC. 2013 have a significant corellation comparing the runoff observation as mentioned in the following graphic.

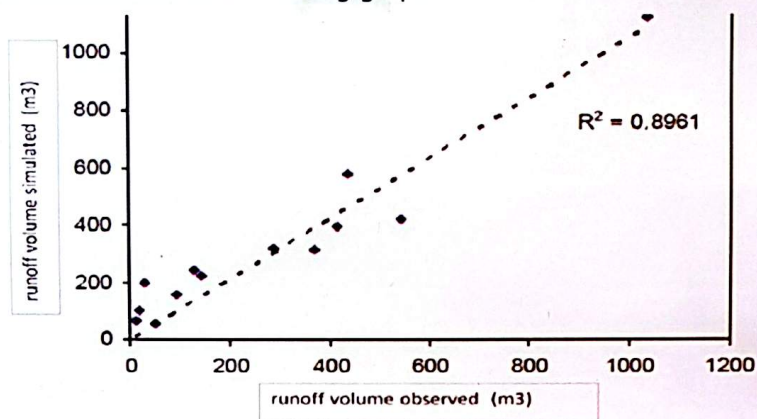


Figure 3. The correlation between volume of observed runoff and simulated runoff

The calculation STREAM runoff in Gumuk micro catchment grown following a rainfall evens takes place in two phases: 1). The evaluation of the volume of water not infiltrated at each point of the basin, then 2). The determination of flow and accumulation of runoff. The calculation functions erosion and diffuse linear proposed by STREAM, were not used. In STREAM, a rainfall event is characterized by rainfall (in mm), the duration (in hours) and the index of the previous rain (rainfall imbibition depends on the soil moisture surface). The volume of water infiltrated is not evaluated for each cell by performing a balance between height and the intensity of the rainfall event and the infiltration capacity.

### Aknowledgement:

I would like to thanks to Mr. Bruno Lidon and Mr. Jean Christophe Poussin for sharing data, informations and picture.

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