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Hydrological design of contour bund and contour trench in Khalikani watershed of Odisha

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ABSTRACT

A study was undertaken to carry out the hydrological design of contour bund (CB) with surplus weir (SW) system and continuous contour trench (CCT) to reduce surface runoff and soil loss in Khalikani watershed of Odisha. One day maximum rainfall of 183.25 mm predicted by the best fit Generalized Pareto Distribution at 5 years return period was used to compute the surface runoff by SCS curve number method and the values for up and medium arable land were obtained to be 140.2 and 128.4 mm, respectively and that for non-arable forest land was 108.4 mm. The above computed surface runoff values were used for the hydrological design of CCT in non-arable forest land and CB with SW system for arable up and medium land conditions. The study revealed that for arable upland, design dimensions of CB are: top width = 45 cm, height of bund = 1.04 m, base width = 3.57 m, side slope = 1.5 : 1 and should be laid at horizontal interval (HI) of 30.5 m and vertical interval (VI) of 1.53 m. Similarly, for arable medium land, design dimensions of CB are: top width = 45 cm, height of bund = 0.59 m, base width = 2.22 m, side slope = 1.5: 1 and should be laid at HI of 91.5 m and VI of 0.915 m. Design dimensions of CCT (rectangular size) for non-arable forest lands are: width of trench = 90 cm and depth = 60 cm and should be laid at HI of 5.0 m and VI of 1.0 m. Moreover, it was observed that a waste/surplus weir of length 1.82 m with depth of weir (rectangular) of 25 cm above the top of CB is required to dispose off peak runoff from arable upland whereas in arable medium land, no such weir is required.

Key words: Contour bund, Contour trench, Hydrologic design, Runoff, Probability

INTRODUCTION

Soil and water are the two important natural resources which are highly essential for agricultural production. The net productivity of crops depends on proper management and utilisation of these vital resources. Uneven distribution of rainfall and absence of suitable soil and water conservation structures cause great loss to crop production in upland of watershed due to water scarcity problem and in lowland due to water impounding conditions. Land degradation, particularly in watersheds together with pressure of ever growing demands for food, fuel and fibre has further aggravated the situation by increasing the needs for intensive cultivation. Degraded lands in the watersheds are characterised by their low productivity potential due to various kinds of constraints related to rainfall management, soil, topography and biotic interference.

Construction of rainwater harvesting structures, contour bunds (CB), contour trenches, earthen embankments, masonry check dams etc. are some of the important activities undertaken in watershed development programs. Contour trench is one of the most efficient technologies for restoration of degraded lands which brings desirable changes through *in-situ* conservation of soil moisture and nutrients. Contour trench in non-arable uplands and barren hillocks forms the most important measure and is given the highest priority for treatment of sloping lands in watershed rehabilitation programs (Samra *et al.*, 2004; Mishra *et al.*, 2006; Kurothe *et al.*, 2012). CB is another important soil and water conservation measures adopted mostly in areas where sheet and rill erosion are prevalent. It is generally adopted in medium sloppy lands with slope less than 5 percent. It is practised in medium depth of soil

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