Evaluation of SCS-Curve Numbers and Runoff across Varied Tillage Methods

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Abstract : The soil conservation service curve number (SCS-CN) is a widely used method to assess direct runoff depth based on specific rainfall events. "Actual" estimated runoff depth was estimated by subtracting the change in soil moisture from the depth of precipitation for each discrete rain event during the growing seasons from 2021 to 2023. Fields under investigation were situated in a HUC-12 watershed in southeastern South Dakota selected for a common soil series (Nora-Crofton complex and Moody-Nora complex) to minimize the influence of soil texture on soil moisture. Two soil moisture probes were installed from May 2021 to October 2023, with exceptions during planting and harvest periods. For each field, "Textbook" CN estimates were derived from the TR-55 table based on corresponding mapped land use land cover LULC class and hydrologic soil groups from web soil survey maps. The TR-55 method incorporated HSG and crop rotation within the study area fields. These textbook values were then compared to actual CN values to determine the impact of tillage practices on CN and runoff. Most fields were mapped as having a textbook C or D HSG, but the HSG of actual CNs was that of a B or C hydrologic group. Actual CNs were consistently lower than textbook CNs for all management practices, but actual CNs in conventionally tilled fields were the highest (and closest to textbook CNs), while actual CNs in no-till fields were the lowest. Preliminary results suggest that no-till practice reduces runoff compared to conventional till. This research highlights the need to use CNs that incorporate agricultural management to more accurately estimate runoff at the field and watershed scale.

Keywords : curve number hydrology, hydrologic soil groups, runoff, tillage practices

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