

## Comparing the Effect of Two Rainfall Storage Methods on Changes in Soil Moisture and Herbaceous Plants Phytomass in Steppe Rangelands: A Case Study of Darmian City's Rangelands, South Khorasan Province

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### Extended Abstract

**Introduction:** Ninety percent of Iran's surface is under arid and semi-arid climates. However, low precipitation and low permeability of soils are considered as some of the most important natural problems of rangelands in such climates that prevent the successful establishment of plants. Therefore, it is necessary to perform a series of mechanical operations to make optimal use of wastewater and to store the rainfall.

**Materials and Methods:** a factorial experiment was performed via a completely randomized design with three replications and three treatments, including the rainfall storage structure (in five levels), soil depth (in two levels), and sampling season (in two levels) to compare the two methods of contour furrow and catchment crescents. Accordingly, a total of 60 soil samples were collected, which were immediately weighed after harvest and transferred to the soil science laboratory where their weight moisture content was measured individually. Moreover, a randomized systematic plot method was used to measure forage production and compare it to structural type treatments. In each of the treatments, two 100-meter transects were used at a distance of 100 meters from each other, and the total forage was harvested in 50 plots, whose weights were measured as grams per square meter.

**Results:** Analysis of variance of the collected data indicated that the main variables' (structure, depth, and sampling season) effect and the interaction effects (structure  $\times$  depth, structure  $\times$  sampling season, and structure  $\times$  depth  $\times$  sampling season) on the percentage of soil moisture were very significant. Moreover, there was a significant difference ( $P < 0.05$ ) between the percentage of moisture's weight in the catchment crescent treatment with contour furrow, and between these two treatments with the other three ones (i.e., between catchment crescents, contour furrow, and control). The analysis of the data also suggested that when measured by the contour furrow method, the soil's moisture was 13.3% and 66.2% higher than the control treatment at the depth of 20-50 cm in the first and second sampling seasons, respectively. on the other hand, when measured by the catchment crescent method, the soil's moisture was 115.9% and 183% greater than that of the control treatment, respectively, indicating that the use of both catchment crescent and contour furrow methods increased moisture storage in deep soil. Furthermore, the study's results showed that the catchment crescents method played a more effective role in soil water storage. It was also found that compared to the contour furrow method, moisture content was increased in the

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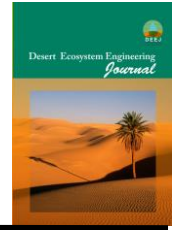
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catchment crescents method by 90.5% and 70.4% in deep soil during the spring and autumn, respectively. Moreover, the results suggested that the amount of forage production was significantly different ( $P \geq 1\%$ ) in the catchment crescent treatment, the contour furrow treatment, and the other three treatments, and that the use of both precipitation storage methods increased forage production in the rangeland, with the production of herbaceous plants being increased by 126% in the contour furrow method and 378% in the catchment crescent method, compared to that of the control. Taking the obtained results into consideration, it could be said that the catchment crescent method was 110% more effective in increasing forage production than the contour furrow method.

**Discussion and Conclusion:** considering the direct relationship between the percentage of soil moisture and the amount of forage production in rangeland plants, it could be argued that increased moisture storage in the soil induced by the use of rainfall storage methods could have a great effect on increasing rangeland plant production, especially perennials. Taking this study's results into account, it can be said that an increase in moisture storage in deep soil because of the application of the catchment crescent method, and, therefore, its added effect on vegetation characteristics, indicates the higher efficiency of the method over the contour furrow one, for which two reasons can be offered: 1- In the catchment crescent method, the runoff is collected from a larger surface on the upstream slope of the crescents, which is then stored in a small area inside each catchment crescent; 2- The depth of the catchment crescent is more than that of the contour furrow (minimum 50 cm vs. maximum 25 cm), and therefore it stores more runoff inside, giving ample opportunities to the water stored in the catchment crescent so that it can penetrate deep into the soil. Therefore, it can be suggested that the relevant organizations use the catchment crescent method instead of the contour furrow one to store precipitation in the soil so that they can improve and rehabilitate the rangelands.

**Key words:** Rangeland improvement, soil moisture, rainwater catchment systems, catchment crescents.