

Runoff and Soil Loss as Influenced by Tillage Practices and Vegetative Barrier in a Shallow Alfisol

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Abstract

A field experiment was conducted during *kharif* 1993-94 at Rajendranagar, Hyderabad on a shallow gravelly sandy loam soil (Alfisol) with an average slope of 2.5 per cent to study the effect of different conservation tillage practices and vegetative barrier (khus or vetiver-*Vetiveria zizanioides*) on runoff and soil loss with castor crop. The runoff causing rainfall during the crop growth period in eight events was 234.1 mm. Highest runoff of 15.01 per cent of rainfall and soil loss of 2.97 t/ha was recorded in the treatment, cultivation along the slope. Formation of ridges and furrows in a crop sown on contour in combination with vetiver barrier resulted in highest reduction in runoff (88.47 per cent) and soil loss (91.92 per cent) when compared to sowing along the slope (control). The soil moisture content and seed yield (9.75 q/ha) of castor were also highest in this treatment. Formation of dead furrows on a contour sown crop in combination with vetiver barrier was the next best in reducing the runoff and soil loss and increasing the soil moisture and crop yield. Contour vegetative hedge reduced the runoff and soil loss by about 61 and 73 per cent, respectively.

Introduction

Alfisols are the predominant soils in Southern Telangana zone of Andhra Pradesh having undulating topography with slopes upto 5 per cent. More than 70 per cent of the area is under rainfed cultivation. Runoff and soil erosion are the major problems in these slopy lands restricting the crop yields. Castor is the most important commercial crop grown in these soils under rainfed cultivation. Though, Andhra Pradesh ranks first in castor area in India, the crop yields are very poor. The yields can be substantially increased through appropriate soil and water conservation practices. Hence, the present study was taken up with low cost technologies involving contour cultivation, tillage practices and vetiver barrier to find out their efficacy in reducing runoff and soil loss and increasing soil moisture and yield of castor crop.

Materials and Methods

A field experiment was conducted at Rajendranagar, Hyderabad during *kharif* season of 1993-94 on a shallow Alfisol (gravelly sandy loam) having a slope of 2.5 per cent. Castor crop (var. Aruna) was taken up with a spacing of 90 x 20 cm and recommended fertilizer dose of 40:60:0 N, P₂O₅ and K₂O kg ha⁻¹. The six treatments tested were : sowing along the contour (T₁), sowing along the contour with vetiver barrier (T₂), sowing along the contour with dead furrows (T₃), sowing along the contour with dead furrows and vetiver barrier (T₄), sowing along the contour with ridges and furrows and vetiver barrier (T₅) and sowing along the slope (T₆-control). The plot size was 210 m²

(35 x 6 m) laid out in randomised block design with 4 replications. Vetiver grass which was planted in June, 1988 and formed into a continuous hedge was used as vegetative barrier in the treatments. Runoff was calculated from the volume of rainwater collected in the locally fabricated runoff measuring troughs installed at the end of the plots. The soil loss was estimated from the runoff rainwater. The soil moisture content upto 45 cm depth was estimated gravimetrically throughout the crop growth period at regular intervals. Castor seed yield was recorded plotwise.

Results and Discussion

Runoff and soil loss : The total runoff causing rainfall during the crop growth period was 234.1 mm in 8 events. Highest runoff of 35.14 mm (15.01 per cent) was recorded in the control i.e., sowing along the slope (T₆) (Table 1). The treatment, sowing along the contour with ridges and furrows and vetiver barrier (T₅) recorded the lowest runoff of 4.05 mm (1.73 per cent). Dead furrows on contours with vetiver barrier was next best with a runoff of 7.18 mm. The per cent reduction in runoff was highest (88.47) in treatment T₅ compared to T₆. This was followed by T₄ (79.57 per cent) and lowest (12.35 per cent) was recorded with the treatment T₁ i.e. sowing along the contour.

The total soil loss (t/ha) was highest (2.97) in T₆ i.e. sowing along slope (control). It was lowest (0.24) in T₅ where the per cent reduction in soil loss was highest (91.92) as compared to control. This was followed by T₄ (87.88). Data in Table 1 also demonstrated that the runoff and soil loss were

considerably reduced in the treatments where vetiver barrier was included as a combination.

Due to contour ridges and furrows, the rainwater was collected in furrows to a greater extent resulting in reduced run-off. As the runoff was less, the soil carried away along with the running water was also less. Dead furrows formed at 3.6 m acted as temporary reservoirs of water that was collected from the 3.6 m land above the furrows. So the runoff was reduced and hence, the soil loss was also low. Vetiver grass which formed a dense hedge, acted as a barrier and slowed down the velocity of running water. There was more infiltration time and more water entered the soil.

When the sowing was done along the slope, the rain water moved with greater velocity as there was no obstruction resulting in higher runoff and soil loss. A reduction of 25.8 and 43.4 per cent of run off and soil loss, respectively due to ridges and furrows has been reported by AICRPDA (1991-92) at Bhubaneswar. A reduction in runoff by 26 per cent due to contour sowing and furrowing has been reported by CRIDA (1988).

Soil Moisture : Ridges and furrows in combination with vetiver barrier (T_5) resulted in highest (9.54 %) mean soil moisture content (Table 2). The per cent increase in soil moisture due to this treatment over T_6 was 24.38. Dead furrows in

Table 1. Effect of tillage practices and vetiver barrier on runoff and soil loss

Treatments	Runoff (mm)	Percent runoff	Percent reduction over control	Soil loss (t/ha)	Per cent reduction on over control
T_1 Sowing on contour	30.80	13.16	12.35	2.54	14.48
T_2 Contour + vetiver	10.55	4.51	69.98	0.62	79.12
T_3 Contour + dead furrows	16.44	7.02	53.22	1.21	59.26
T_4 Contour + dead furrows + vetiver	7.18	3.07	79.57	0.36	87.88
T_5 Contour + ridges and furrows + vetiver	4.05	1.73	88.47	0.24	91.92
T_6 Sowing along the slope	35.14	15.01	-	2.97	-

Table 2. Effect of tillage practices and vetiver barrier on mean soil moisture content (45 cm depth) and seed yield of castor

Treatments	Soil moisture (% w/w)	Per cent increase over control	Seed yield (q/ha)	Per cent increase over control
T1 Sowing on contour	8.00	4.30	8.14	8.97
T2 Contour + vetiver	8.41	9.65	8.79	17.67
T3 Contour + dead furrows	8.33	8.60	8.73	16.87
T4 Contour + dead furrows + vetiver	8.91	16.17	9.23	23.56
T5 Contour + ridges and furrows + vetiver	9.54	24.38	9.75	30.52
T6 Sowing along the slope	7.67	-	7.47	-
S.Em+	-	-	0.07	-
CD (5 %)	-	-	0.21	-

combination with vetiver barrier were the next best with a mean soil moisture content of 8.91 per cent. The lowest mean soil moisture content (7.67 %) was observed in the control (T_6). Formation of ridges and furrows in contour sown crop retained rainwater in the furrows which acted as reservoirs of water. This provided more opportunity time for the rainwater to infiltrate into the soil thereby increasing profile soil moisture content. Dead furrows acted as temporary reservoirs and retained rainwater in them giving more opportunity time for the rainwater to enter the soil and thereby increased soil moisture content. Increase in soil moisture content due to dead furrows, ridges and furrows and vetiver barrier have been reported by Reddy *et al.* (1991) and Uma Devi *et al.* (1991).

Seed yield : Ridges and furrows in combination with vetiver barrier (T_5) gave significantly higher yield of 9.75 q/ha over other treatments (Table 2). Dead furrows in combination with vetiver barrier (T_4) were the next best with 9.23 q/ha. The lowest seed yield was recorded in T_6 i.e. sowing along the slope (7.47 q/ha). The per cent increase in seed yield in T_5 and T_4 over T_6 was 30.52 and 23.56, respectively. Increase in seed yield due to tillage practices and vetiver barrier may be

attributed to increase in soil moisture content which resulted in better crop growth leading to higher crop yield.

It can be conducted that sowing of castor on contour and formation of ridges and furrows in combination with vetiver barrier planted at 1 m vertical gradient is an effective practice to reduce runoff and soil loss and to increase soil moisture content for higher crop yields in rainfed shallow Alfisols of Southern Telangana Region of Andhra Pradesh.

References

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