FARMING PRACTICE
LANDSCAPE FEATURES

IMPACT: SOIL EROSION

Reference 19

Mandal, D; Srivastava, P; Giri, N; Kaushal, R; Cerda, A; Alam, NM 2017 Reversing land degradation through grasses: a systematic meta-analysis in the Indian tropics SOLID EARTH, 8(1), 217-233. 10.5194/se-8-217-2017

Background and objective

In India most of the studies on the role of grasses as vegetative/filter strips have been done in isolation with fewer slope categories and with limited objectives restricted to soil erosion. We aim to synthesize and discuss the past scientific studies pertaining to the effect of grasses in arable and non-arable lands on one of the key determining soil processes, namely reduction in soil and water losses and enhancement of infiltration.

Search strategy and selection criteria

Information on the usefulness of grasses in soil and water conservation was collected from published literature. 1) Studies where both reference site (bare land/fallow land) and grass treatments were present; 2) The reference sites were adjacent to the grass-treated field/plots within the same landscape and similar slope. Therefore, studies where the reference site was either missing or was away from the study site were excluded.

Data and analysis

Data were analyzed using SPSS (version 17). The analysis of variance (ANOVA) was conducted to test the significant difference between different treatments. Initially, a t test was conducted to test whether the impacts of two treatments (without grass and with grass) were significantly different. Protected least significant difference (LSD) at P = 0.05 was used to separate the means for all the three different categories of data. A separate t test was also used for different slope classes to evaluate the performance of contour grass barriers on the reduction of soil and water loss and enhancing crop yield.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
83	Croplands and cropland in sloppy areas	Contour grass barrier	1) Bare land/fallow land; 2) Withour grass barrier	Metric: Run-off; soil loss; Effect size: 1) Ratio of the considered metrics in the intervention to the considered metrics in the control; 2) Standardized difference of the considered metrics between intervention and control	43.75

Results

- The overall result of the meta-analysis showed that infiltration capacity increased approximately 2-fold after planting grasses across the slopes in agricultural fields (95% confidence level).
- Runoff and soil loss values in CGB plots were lower than the control plots. The data show that runoff varies be- tween 11.26 and 62.60% with a mean value of 37.71% and soil loss varies between 0.53 and 30.90Mgha−1 yr−1 with a mean value of 9.56Mgha−1 yr−1 in control treatments (Ta- ble 3). With CGB, the runoff data varies between 5.87 and 44.10% with a mean value of 20.93% and soil loss varies between 0.50 and 18.70Mgha−1 yr−1 with a mean value of 3.93Mgha−1 yr−1.

Factors influencing effect sizes

- Field edge vegetation type : Some grass species are more effective than others in reducing runoff and soil loss.
- Slope : Loss of water was significantly lower in contour grass barrier-treated sites with < 2 % slopes. However, this trend was not observed in the 2–4 % slope range. The soil loss was significantly lower in contour grass barrier-treated sites in higher slopes (2–4 and > 4 % slopes).

Conclusion

The overall result of the meta-analysis showed that infiltration capacity increased approximately 2-fold after planting grasses across the slopes in agricultural fields, which reduced the runoff by 45% and the transported soil by 59% compared to control (no grass). The use of grass barriers was effective and efficient for decreasing soil and water loss on sloppy croplands in tropical and subtropical regions of India.