



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 3, March 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.569

9940 572 462

6381 907 438

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Studies of Soil Binding Capacity of five plants for Protection of Ravines

Dr. Renu Sharma

Assistant Professor, Department of Botany, G.D.H.G. College, Moradabad, Uttar Pradesh, India

ABSTRACT: Improper land use leads to accelerated soil erosion which further results in the formation of gullies and ultimately to very deep gullies or ravines. Ravine reclamation are continuous processes and the continuous monitoring of the problem area is crucial. In this paper, I have studied and analyzed five plants for reclamation and stabilization of the soil of Yamuna ravines. Based on my study on Ravines, I observed that *Saccharum munja* Roxb., *Desmostachya bipinnata* (Linn) Stapf, *Cenchrus ciliaris* Linn, *Cynodactylon* (Linn) Stapf and *Ipomoea fistulosa* Mart. ex Choisy. are the five plants help in the stabilization and reclamation of ravine land.

KEYWORDS: Ravine; reclamation; Stabilization and binding capacity.

I. INTRODUCTION

An intensive system of gullies form ravines. These ravines are caused by rivers and their tributaries, extending towards agricultural lands and habitation. The National Commission on Agriculture estimated that 36.7 lakhs hectares land in India is ravine land. Out of this 12.3 lakhs hectares of ravines are located in Uttar Pradesh alone which works out to approximately 33% of the total land in the country and 75% (2.76 million hectares) are spread over in the states of Uttar Pradesh, Madhya Pradesh, Bihar, Rajasthan and Gujarat. Where the land surface is bared of protective vegetation, erosion agencies become a thousand times more furious in their ghastly action of erosion than under natural conditions. Uncontrolled erosion has been observed to deplete the production base of the land and possess a great problem to the growth and production of vegetation. In India, it has been estimated that a total 5.334 million tonnes of soil are lost annually which works out to 16.4 tonnes/ hectare. It has further been estimated that colloidal particles (organic matter and clay) and other finer particles are first eroded and transported. These colloidal particles are known to be the seat of production and chemical reaction in the soil. Along with soil, a considerable amount of plant nutrients is also wasted out in the process of erosion which is about 30-50% of the nutrients supplying capacity of the soil, depending on the gradient and protective measures.

II. RELATED WORK

This research paper is based on the fact that the chances of a land area becoming ravine are more when the land is bare. It is very important to know what kind of plants treat the condition of ravines because this is a serious problem in India and here the land area in proportion to the population is very low, so we can't afford the loss of land. In this paper, we have examined the soil binding capacity of different plants. This study was carried out by Uprunch Trench Wash method and Box Cut method. Uprunch Trench wash method was given by Uprunch in 1951 and Box cut method by Bhimaya in 1956.

III. METHODOLOGY

Studies of soil binding capacity was carried out by two methods

1. Uprunch's Trench Wash Method
2. Box cut method

Uprunch's Trench Wash Method

The lateral spread and angular position of roots were studied on half of the side by exposing the plant by Uprunch's trench wash method. The grass tussock was divided into four equal parts by stretching two thin wires from the centre perpendicular to each other. The ends of these wires were firmly fixed in position with pegs. These wires constituted the X and Y axis respectively. Observation of roots related to the number, depth, length, horizontal extent, diameter, standard deviation in angular position of roots were noted. The diameter was measured at 2-3 places with screw gauge.



Standard Deviation

$$S.D.= \sqrt{1/2[a_1^2+a_2^2+a_3^2 - (a_1+ a_2+ a_3)^2/3]}$$

Where a₁, a₂ and a₃ represent percentage of roots in the 0°-30°, 30° -60° & 60° -90° angular ranges.

Box cut method

The quantity of roots added to the soil was studied by box cut method of Bhimaya et al. (1956). The quantity of root material added per hectare to the soil depth of one foot by the species is calculated by the weight of the roots in a known volume of soil. A box of 1'X1'X1' dimensions was prepared out of an iron sheet 6.5 mm in thickness. The top corners of the box were reinforced with thick iron plates to sustain the hammering for forcing the box into the soil. Three inches from the base, a horizontal slit was provided to slip in an iron plate of 6.5 mm to cut the soil block in the box at exactly one foot depth. This extra plate was provided with a handle sufficiently thick to sustain hammering for cutting the inner block. The box was water adequately and then carefully placed on the plant so that was more or less in the centre. By applying uniformly force pressed the box until the soil surface become in level with the top of the box and now horizontal plate inserted. The box with the soil carefully lifted. Roots were then carefully removed from the soil and measured.

IV. RESULT AND DISCUSSION

By studying the five plants that is *Saccharum munja* Roxb., *Desmostachyabipinnata* (Linn) Stapf, *Cenchrus ciliaris* Linn, *Cynodondactylon* (Linn) Stapf and *Ipomoea fistulosa* Mart ex Choisy, it was observed that *Saccharum munja* Roxb. ranked first because it showed superior root characteristics i.e. maximum number of roots it was followed by *Cynodondactylon* (Linn) Stapf and *Desmostachyabipinnata* (Linn) Stapf, and then by *Cenchrus ciliaris* Linn lowest number of roots in *Ipomoea fistulosa* Mart ex Choisy, maximum effective horizontal extent which was followed by *Desmostachyabipinnata* (Linn) Stapf, *Ipomoea fistulosa* Mart ex Choisy, *Cenchrus ciliaris* Linn and *Cynodondactylon* (Linn) Stapf. maximum total and average length followed by *Desmostachyabipinnata* (Linn) Stapf, *Ipomoea fistulosa* Mart ex Choisy, *Cenchrus ciliaris* Linn and *Cynodondactylon* (Linn) Stapf and maximum soil binding value it was followed by *Desmostachyabipinnata* (Linn) Stapf, *Cynodondactylon* (Linn) Stapf, *Cenchrus ciliaris* Linn and *Ipomoea fistulosa* Mart ex Choisy. Sharma et al. (2005) also reported that the highest soil binding capacity of *Saccharum munja* Roxb. Sharma and Sharma (1995) also found that *Saccharum munja* Roxb. was a better binder for the lower layers, consequently the high number of roots produces a denser network, providing a higher soil binding capacity the species Prajapati et al., (1973) and Shankarnarayan et al., (1974). Mishra and Sharma (2014) also reported that *Saccharum munja* Roxb was ranked first as the suitable grass with highest soil binding capacity, it was followed by *Desmostachyabipinnata* (Linn) Stapf and *Dichanthium annulatum* (Forsk) Stapf.

Trench Wash Method

S.No.	Name of Species	No. of Roots	Average depth	Horizontal extent	Maximum length
1.	<i>Saccharum munja</i> Roxb.	912	74	180	184
2.	<i>Desmostachyabipinnata</i> (Linn) Stapf	558	67	165	171
3.	<i>Cenchrus ciliaris</i> Linn	195	58	115	149
4.	<i>Cynodondactylon</i> (Linn) Stapf	615	47	65	144
5.	<i>Ipomoea fistulosa</i> Mart ex Choisy	120	89	150	163

**Box Cut Method**

S.No.	Name of Species	Size of unit volume of Soil taken	Average Radius of Roots and stolon in mm (r)	Weight of Roots and Stolon in gm (w)	Value of w/r^2
1.	<i>Saccharum munja</i> Roxb.	1'X 1' X 1'	0.67	180.36	401.78
2.	<i>Desmostachya bipinnata</i> (Linn) Stapf	1'X 1' X 1'	0.46	70.56	333.45
3.	<i>Cenchrus ciliaris</i> Linn	1'X 1' X 1'	0.55	73.45	242.809
4.	<i>Cynodactylon</i> (Linn) Stapf	1'X 1' X 1'	0.50	65.46	261.84
5.	<i>Ipomoea fistulosa</i> Mart ex Choisy	1'X 1' X 1'	1.30	75.02	44.39

V. CONCLUSION

The roots of *Ipomoea fistulosa* Mart. ex Choisy were superior in depth penetration and diameter which is followed by *Saccharum munja* Roxb. So, these species played important role in reducing the runoff and soil loss. Chatterjee & Maiti (1974) and Bhushan et al. (1984) also reported that the run off and soil loss was significantly reduced under natural grass cover.

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