Estimation of Soil Conservation Value of Some Grasses and Sedges of Ravine Wetland (Adhwara River, Ekmighat) of Darbhanga

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ABSTRACT: *Soil erosion and sediments discharge are taken as one of the prevalent issues associated with river banks and around such other wetlands. Soil surface covered with grasses and sedges reveals minimum soil erosion in compare to an uncovered one. Covering with grasses and sedges to such river banks and coastal areas could be one of the most effective methods in reducing soil erosion and sediment discharge. Flood as well as the heavy rain is such debacles that bring major soil erosion and the crop loss destitution. So the soil conservation is needed to be taken as a very noteworthy to these areas.In this context this study comes with the soil conservation values of eighteen grasses growing around Adhwara River that are estimated in two phases using soil from adhwara ravines. Mnesitha laevis showed maximum conservation value followed by Dichanthiumannulatum and Digitaria satigarus. In the second phase Fimbristylis bisumbileta got the maximum conservation value followed by Kylinga brevifolia. It is found that grasses have higher soil conservation value (Mnesitha laevis -91.41) than sedges (Cyperous iria-70.21).The root systems were quite effective in fully established (4½ months old) grasses.*

Key Words: *Monolith, Ravine, Rhizomatous, Soil conservation value, Soil erosion.*

Introduction:

The prostrate, creeping, and rooting stems cover the surface of ravine land and these protect them effectively from the action of winds and waves. Various major factors are there viz.Hydrology, topography, soil erodibility, soil transportability, soil surface cover, incorporated residue, residual land use, subsurface effects, tillage, roughness, and tillage marks affect the upland erosion processes. The extensively creeping rhizomes make a perfect network of strong fibers, effectively binding the drifting sands of the coast as well as the source of excellent forage. Further for holding the muddy banks of rivers and streams several native grasses may also be employed. Seeing the erosion issues it is necessary to do a planning in soil conservation because it is an important requirement in sustainable farming. The basics of soil erosion control are to reduce detachment and transportation capacity of the eroding agent (water and wind) through different agronomic, vegetative measures that is generally known as conservative measures (Amatya and Shrestha.,2002). Importance of vegetation in the abatement of soil erosion and thereby in stabilizing the gullies and ravine has been widely advocated (Stocking 1984, Young 1989, Ambasht and Shankar 1993). Chatterjee and Maity (1974) observed that almost all grasses controlled soil loss. Shrubs and perennial grasses have been considered more effective in halting runoff and erosion than the agro-effective in halting runoff and erosion than the agro-forestry crops (Anwar et. al, 1989).

As an attempt of finding out the soil conservation value of some soil binders vegetation,this experiment has been conducted in the vicinity of the river involving some grasses and sedges species commonly growing in the ravine wetland of Darbhanga.

Materials and Methods:

To observe the prevention of soil erosion by grasses two parallel soil bund constructed from the soil of same ravine land, each of 15 meters long slopping at an angle of 30^0 into a common concrete channel measuring about 1m deep. Each of two was divided into five equal block of 3 meters length each. The block was partitioned longitudinally and transversely in order to receive the run offs from each block separately. Thus ten slopping of equal size, built of same soil of equal weight were made ready each with a cemented collection reservoir for runoff soil with water draining outlets. One plot was left bare as control and the rest nine were planted with different species of identified grasses on both sides and top of bunds. Same process was repeated for sedges also. Three complete sets of replicates were taken in each phase of experiment by constructing similar bunds bringing the same soil from same place, thoroughly mixed to make it uniform.

The experiments were conducted in rainy seasons simulating natural growth condition. Eighteen grasses were Identified and established separately as a stock. Just after first shower of the rains in the month of May 2013 & 2014, plants were established from the stocks of seedlings. To calculate conservation value or soil binding capacity of grasses at various stages of growth and different rain intensity, the cemented reservoir were washed free of soil and then outlets were plugged. After heavy rainfall the soil and water from the sloping plots (both bare and under grass covering) got collected in respective reservoirs. The soil was left undisturbed to settle and after a couple of days then water was slowly drained out leaving the soil at the bottom. It was collected and weighed after complete air and oven drying. Thus the quantity of soil eroded from the plant covered and bare plots under identical condition were determined separately.

The soil conservation value was then calculated as the percentage of soil retained which otherwise without the plant cover would have been washed away when subjected to erosive force. The formula may be given as:

$$Cv = 100- (Swp/Swo\times100)$$

Cv = Conservation value

Swp = Amount of soil washed from plant covered plot

Swo = Amount of soil washed from bare plot.

<u>Conservation Value Of Some Grasses:Phase-I [May 2013-October 2013]</u>

State of growth	Early stage (1½ months old)		Fairly established (3 months old)		Fully established (4½months old)		Clipped aerial part (root system present)	
Rainfall (mm)/4day Artificial Rain	60 mm		87 mm		125mm		120 kg water through 2mm pore size from 130 cm height	
Species	Dry wt. of eroded soil(gm)	Conservation Value	Dry wt. of eroded soil /g	Conserv. value	Dry wt. of eroded soil /g	Conservation value	Dry wt. of eroded soil /g	Conservation value
Mnesitha laevis	**1050.25 ±125.5**	**69.38**	**650.65 ±50.60**	**80.97**	**290.50±45.8**	**91.41**	**810.0±75.5**	**76.08**
Dichanthim annulatum	1130.35± 55.30	67.05	638.32±75.6	81.31	318.46±65.85	90.66	835± 75.5	75.36
Digitaria satigarus	1160.65± 65.40	66.16	680.55±45.35	80.10	410± 40.9	87.97	855.6±35.8	74.76
Digitaria sanguinalis	1165.75± 55.6	66.01	685.50±30.8	79.95	445.75±25.7	86.92	870.6±110.7	74.31
Cynodon dactylon	1170.65± 68.5	65.87	710.45±55.15	79.22	480± 45.75	85.92	860.30±45.75	74.62
Paspalum dilatum	1175.25± 135.7	65.73	695.55±45.2	79.07	490.75±85.75	85.78	885.80±150.4	73.87
Echinochloa colona	1195.35± 210	65.15	715.65±45	79.07	510 ±55.8	85.04	890.20±55.7	73.74
Erichloa procera	1280.30± 150.5	62.67	738.32±45.8	78.41	420.46±60.80	84.73	825.20 ±70.6	75.65
Zoysia matrella	1310.30± 180	61.79	760.65±75.80	77.75	545.75±30.80	83.99	910± 95.10	73.15
Control/bare plot	3430± 170.5		3420± 185.75		3410± 210.7		3390± 176	
Phase: II [May 2014-October 2014]								
Fimbristylis bisumbileta	1390.30± 185.8	60.67	780.6± 85.7	77.79	510.50± 70.45	85.45	790±80.5	77.10
Kylinga brevifolia	1440.3± 210.5	59.25	830.8± 105.5	76.36	565.55± 95.6	83.88	835.5± 105.2	75.78
Leptochloa chinensis	1460.5± 215.5	58.68	855.2± 115.5	75.66	585.50± 85.75	83.31	855.9± 95.85	75.19
Cyperous compressus	1490.3± 220	57.84	880.6± 115.65	74.94	610.55± 45.75	82.60	875.7± 90.60	74.61
Eleusin indica	1480.8± 175.80	58.10	905.6± 105	74.23	650.70± 80.50	81.46	905.3± 110.75	73.75
Paspalum flavidum	1540.5± 195	56.42	930.6± 65.95	73.52	665.95± 75.90	81.0	925.7± 75.3	73.16
Chrysopogon acculatus	1570.4± 225	55.57	965.1± 110.5	72.54	690.95± 70.60	80.31	960.2± 90.45	72.16
Panicum sumatrense	1610.8± 230.5	54.43	995.4± 120	71.67	735.75± 95.60	79.03	990.8± 120.8	71.28
Cyperous iria	**1855.3± 190.8**	**47.51**	**1290.± 75.90**	**63.29**	**1045.4± 70.21**	**70.21**	**1245.0±115.7**	**63.88**
Control plot	3535±235		3515±215		3510±190.5		3450±195	

Result and Discussion:

The preparation of bund was carried out by using thesoil from same ravine land that was alluvial, highly calcareous. Mixture of clay and sand makes it suitable for growing natural vegetation. Calculation of conservation value of plants were started when these were in early stage of their growth (1½ months old) with arrival of monsoon showed less conservation value due to its tender growth and least spreaded roots. It was found that in the first phase of the experiment, when they were fully established (4½ months old), *Mnesitha laevis* showed maximum conservation value (91.48) followed by *Dichanthium annulatum* , *Digitaria satigera, Digitaria sanguinalis*, and *Cynodon dactylon* (90.66, 87.97,86.92, and 85.92 respectively).

When above ground parts were clipped, then soil conservation value decreases up to certain extent but were more or less on the same sequence except *Erichloa procera* showed more value than *Dichanthium annulatum* as the latter propagate vegetatively by runner. In the second phase Fimbristylis acculatus (forbs) showed maximum conservation value (85.45) followed by Kylinga brevifollia. From the two phase of experiment we found *Mnesitha laevis* showed maximum conservation value (91.48) and Cyperous iria had the lowest conservation value (70.21). The species having more thinner reticulated root, occupied more space, hold more soil exhibited more soil conservation value than the thicker one such as *Dichanthiumannulatum, Digitaria satigera and Cynodon dactylon*. The rhizome and reticulately branched finer root penetrate the soil in all direction exert considerable binding effect, unlike main root they are composed largely of young actively absorbing tissues. The prostrate, creeping, and rooting stems cover the surface of ravine land, protecting them from the action of winds and waves quite effective. The extensively creeping rhizomes make a perfect network of strong fibers, effectively binding the drifting sands of the coast as well as source of excellent forage. For holding the muddy banks of rivers and streams grasses and forbs with higher soil conservation value may be employed. Soil conservation is an important requirement in sustainable farming, basics of soil erosion control are to reduce detachment and transportation capacity of the eroding agent (water and wind) through different agronomic, vegetative measures generally known as conservative measures (Amatya and Shrestha,2002). Anwar et al. (1989) have compared the effect of native plant cover for protection of runoff and erosion from slopping lands and found that shrubs were more effective (almost showing negligible soil loss) than agroforestry crops..The binding power of underground plant parts and their resistance to erosion have been ascertained by a series of experiment with prairies grasses by Weaver & Harman (1935) and Weaver (1958). Bhimaya et al. (1956) gave a relationship that the soil binding factor is directly proportional to the dry weight of roots in a unit volume of soil and inversely proportional to the mean radius of the roots. The binding effect of root mainly depends upon the weight, length, thinness of root, volume, total number of roots and root hairs play pivotal role. Root development of different species varies with different climatic condition and soil composition. Under experimental condition, by raising pure population of the some of the species on slopes, Ambasht (1962, 1963, 1970) estimated the soil conservation value of herbaceous species against erosion. On the basis of experiment it may be conclude here that the rhizomatous plant with spreaded numerous branched thinner root along with root hairs occupying more space and volume proved as better soil binder and can be advised to farmers or agency to use it to sort out forage and erosion problem in less cost, however these must be tested before propagating them in different habitats for better result. Perennial grasses may be preferred as soil binders because of its wholly developed established deep root system.

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