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Weed management strategies for rejuvenation of tiger grass infested pastures existing on river bed deposits in Shivalik foothills of Jammu

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ABSTRACT

A field experiment was conducted to study the efficiency of different weed management interventions in improving the carrying capacity of tiger grass (*Saccharum spontaneum* L.) infested pastures existing on riverbed deposits during 2002-03 to 2004-05 with nine treatment combinations comprising of manual eradication, glyphosate application 0.75 and 1.0% and agrostological interventions with 3 grass species in a randomized complete block design with three replications. After three years of treatment imposition, it was found that the application of either 0.75 or 1.0% glyphosate followed by planting either of napier hybrid (NB-21) or *Cenchrus ciliaris* was found equally effective in establishing a good grass cover as compared to *Setaria* as well as in smothering the regenerated growth of *Saccharum* plants resulting in reduction of its fresh biomass to 9.02-13.0 q/ha i.e. less by 90-94% as compared to its initial biomass of 116 q/ha which in turn was statistically similar to manual eradication of this weed. However, the application of glyphosate 0.75% on the regenerated growth of spring shaven *Saccharum* just before rainy season followed by planting of napier cuttings or *Cenchrus ciliaris* Rooted slips was found to be economically better with a net saving of Rs 500 and Rs 13970 over all the other similar treatment combinations of 1% glyphosate as well as manual eradication, respectively, besides a sizeable enhancement in forage yield.

Key Words : Tiger grass, Manual eradication, Grubbing, Herbicide, Grasses

In Jammu & Kashmir, livestock is an integral component of agricultural farming system. About 15% of the population draws sustenance from migratory livestock husbandry. Livestock sector has shown steady growth, both in horizontal and vertical terms, and total animal population at present is estimated about 9.9 million. There is a paucity of feed and fodder for the livestock, especially during winter months as a result their productivity suffers. Forests and grasslands are two important natural land use systems in the state. For high biotic pressure on these lands particularly due to livestock migration, incidence of grazing is much higher than the potential of natural grasslands, turning them into degraded lands. Cultivation of fodder is practiced on a limited scale due to small land holdings, less irrigated area and poor socio-economic condition of the farming community. The feed and fodder requirement is supplemented by grazing on grasslands and forests, leaves of fodder trees and native grasses. The deterioration of pastures, grasslands and other grazing lands may be ascribed to the large bovine population, free grazing practices, lack of management and natural constraints like extremes of temperature, steepness of slopes, variable precipitation, scarcity of moisture and more often due to infestation of obnoxious weeds like *Saccharum spontaneum.*

Saccharum spontaneum L. one of the two species of wild cane popularly known as 'Kans grass' is a perennial and highly variable species ranging broadly in its native Asia and competing vigorously on extreme disturbance prone sites. It has also become invasive throughout the tropics on agricultural soils degraded by over use. Its creeping and penetrating root system, propagation by seeds as well as underground rhizomes and dissemination to long distances by wind are all responsible for its aggressive nature to eliminate the native flora wherever it is established. A severe problem of infestation of this wild sugarcane (*S. spontaneum*) weed had depleted the native flora and almost dwindled the forage resources turning lush green pastures of sub-tropical foot hills of Jammu and Kashmir into extremely poor and unproductive pastures. It has resulted into shrinkage of area for animal grazing and grass production, animal and human health hazards, threat to the ecology and aesthetic values of the area and finally the problem of environmental degradation besides providing shelter to migrating militants across the India-Pakistan border. Despite the extent of problem, surprisingly almost no work on the restoration of such *S. spontaneum* infested pastures has been undertaken so far. Therefore, to restore the original ecosystem of these degraded pastures, it became imperative to undertake such

investigations directed towards rejuvenation of vast stretches of land encroached by such obnoxious weeds with the objectives to identify most effective and economical technique for improving the carrying capacity of these pastures.

MATERIALS AND METHODS

The study site, dairy goat farm falls in Kathua district of Jammu & Kashmir state. The farm has a total area of about 35 ha out of which nearly 8 ha delineated as pasture land is invaded by obnoxious weeds like *Saccharum spontaneum*. The experimental study to restore the forage productivity of this pasture land pocket was conducted during the year 2002 to 2005. The soil of the experimental site was sandy loam in texture having sand 52.97, slit 19.8% and clay 27.14%, nearly neutral in reaction (pH 7.6) and medium in organic carbon (0.65%), available N (399 kg/ha), phosphorus (17.2 kg/ha) and potassium (140 kg/ha). The experiment consisted of 9 treatments *viz*., T_1 - Manual eradication (grubbing of wild sugarcane during rainy season followed by planting of napier cuttings of 30 cm length having at least 3 nodes), T_2 - Manual eradication (grubbing of wild sugarcane during rainy season followed by planting of *Cenchrus ciliaris* rooted slips), T_3 - Manual eradication (grubbing of wild sugarcane during rainy season followed by planting of *Setaria sphacelata* cuttings of 30 cm length having at least 3 nodes), T_4 - Spring shaving of *Saccharum* clubbed with application of glyphosate 0.75% just before rainy season on about one foot regenerated growth of wild sugarcane followed by planting of napier cuttings of 30 cm length having at least 3 nodes, T_5 - Spring shaving of *Saccharum* clubbed with application of glyphosate 0.75% just before rainy season on about one foot regenerated growth of wild sugarcane followed by planting of *Cenchrus ciliaris* rooted slips, T_6 - Spring shaving of *Saccharum* clubbed with application of glyphosate 0.75% just before rainy season on about one foot regenerated growth of wild sugarcane followed by planting of *Setaria sphacelata* cuttings of 30 cm length having at least 3 nodes, T_7 - Spring shaving of *Saccharum* clubbed with application of glyphosate 1.0% just before rainy season on about one foot regenerated growth of wild sugarcane followed by planting of napier cuttings of 30 cm length having at least 3 nodes, T_8- Spring shaving of *Saccharum* clubbed with application of glyphosate 1.0% just before rainy season on about one foot regenerated growth of wild sugarcane followed by planting of *Cenchrus ciliaris* rooted slips, T_9 - Spring shaving of *Saccharum* clubbed with application of glyphosate 1.0% just before rainy season on about one foot regenerated growth of wild sugarcane followed by planting of *Setaria sphacelata* cuttings of 30 cm length having at least 3 nodes. The experiment was laid out in a randomized complete block design in three repeats. Stem cuttings of napier bajra hybrid (cultivar *NB-21*) and *Setaria sphacelata* were planted in 15 cm screw auger bore holes and cuttings of napier and *Setaria* as well as rooted slips of *Cenchrus ciliaris* were established at a spacing of 60 x 30 cm. Grubbing of *Saccharum* was done under manual eradication treatments. In case of herbicidal treatments, the weed was first cut just near the ground surface during spring, allowed to regenerate and herbicide (glyphosate) was applied when it attained a height of about 30-40 cms followed by planting of grasses during the rainy season. Two manual weedings cum hoeings were given only to the treatments where *Saccharum* was eradicated manually to suppress the regenerated *Saccharum* plants and the other native weed flora to encourage establishment of planted grasses. Re-planting of grasses in gaps occurred due to mortality of the planted grasses was done in next February also. The grasses were allowed to grow and establish till next rainy season. Treatment wise study of fresh above ground biomass of the introduced grasses was carried out at each cut and to evaluate their effectiveness in checking the reoccurrence of the wild sugarcane. The fresh biomass growth of *Saccharum* was also assessed at the completion of the study. Three cuts of grasses each during July, November and March of 2003-2004 and 2004-2005 were taken. Year wise fodder estimation was also done to work out the fodder output of each grass under each treatment. The economics of all the treatments was worked out on the basis of total man days involved for their respective operations as well as costs of the inputs. The identification of the effective technique for rejuvenation of wild sugarcane degraded pastures was done on the basis of significant results realized under less incurred expenditure. Identification of fodders was made keeping in view their aggressively in establishment under the prevailing conditions for suppressing the reoccurring growth and checking the re-entry of wild sugarcane as well as on the respective fodder yields of introduced grasses.

RESULTS AND DISCUSSION

Effect on forage yield of introduced grasses

The results of three years data revealed that one year after imposition of treatments three cuts of each forage grass i.e napier, *Setaria sphacelata* and *Cenchrus ciliaris* were taken each in second and third year. All the three introduced forage grasses differed significantly with respect to their green forage yield (Table 1) with napier (NB-21) recording the highest yield of 178.2 and 247.0 q/ha during second and third years where it was established after grubbing of *Saccharum spontaneunm*. However, this treatment was found to be at par with forage

Table 1. Effect of different treatments on forage yield of introduced grasses during different years

Treatments*	Forage yield (q/ha)							
	2003-04				2004-05			
	First-cut	Second-cut	Third-cut	Total	First-cut	Second-cut	Third-cut	Total
T_1	54.76	64.45	60.05	179.26	80.33	86.66	80.04	247.03
T_2	15.88	16.28	15.66	47.82	18.83	21.23	20.16	60.22
T_3	31.67	32.50	30.67	94.84	31.66	31.83	29.96	93.45
T_4	47.64	61.96	58.50	168.10	79.04	85.23	79.76	244.03
T_5	12.00	15.42	14.66	42.08	17.66	19.83	18.33	55.82
T_6	27.10	31.00	30.07	88.17	29.05	31.00	28.66	88.71
T_7	49.86	60.56	59.53	169.95	78.76	86.00	78.00	242.76
T_8	12.58	16.00	15.66	44.24	17.80	19.40	17.50	54.70
T_9	28.16	32.40	31.16	92.22	30.83	32.00	28.33	91.16
LSD (P= 0.05)	3.48	3.98	2.95	10.54	3.57	3.32	4.95	11.87

* For details of treatment see materials and method.

yield of napier realized where *Saccharum* was controlled with 0.75 or 1.0% glyphosate application. The significant differences in forage yield of various grasses were probably due to differences in their inherent herbage production potential. Moreover the reasons of higher napier yield in weed management treatments might have resulted due to the fact that either initial *Saccharum* eradication by grubbing with two extra intercultural operations or herbicide application had provided congenial conditions for napier grass to establish and flourish initially leading to its higher forage yield. These findings are similar to those of Sood and Sharma (1993). Almost a similar trend was observed in differential behavior of various interventions during individual cuts and during second year of study.

However, among the various forage grasses only two species i.e., napier and *Cenchrus* were successful in improving their total green forage yield substantially with time recording 38.6 to 45.2 and 23.6 to 32.7 per cent increase over that obtained during first year of interventions. The probable reasons for their cumulative yield enhancement can be attributed towards their better establishment under river bed deposit situations.

Effect on tiger grass biomass production

Significant differences in fresh biomass production of tiger grass were recorded under various weed management treatments at the end of the study. However , lower fresh biomass of weed in question (*Saccharum*) was recorded under the treatments where napier and *Cenchrus* grasses were established irrespective of the manual or

Table 2. Effect of different treatments on fresh biomass of tiger grass

Treatments*	Fresh biomass (q/ha)	
	At completion	% Reduction
T_1	9.02	93.00
T_2	9.32	91.96
T_3	12.60	89.13
T_4	9.32	91.97
T_5	9.82	91.53
T_6	13.0	98.79
T_7	8.66	92.53
T_8	9.60	91.72
T_9	12.66	89.08
LSD (P= 0.05)	1.16	-

* For details of treatment,see materials and methods

Table 3. Details of expenditure incurred under different treatments

Treatments	Operations/inputs	Quantity/ha	Unit	Rate (Rs/unit)	Cost of operation/ inputs(Rs/ha)	Total expenditure (Rs/ha)
T_1	a) Manual grubbing of *Saccharum* bushes	265		70	18,550	
	b) Planting material	55,500		0.05	2,775	
	c) Planting of napier cuttings	80	Man days	70	5,600	33,545
	d) Fertilizer Urea DAP	110		6	2,420	
		160		11		
	e) Weeding and hoeing	60		70	4,200	
T_2	T_1 minus cost of planting material(napier) + planting material (*Cenchrus*)	55,500	*Cenchrus* root-slips	0.01	555	31,325
T_3	T_1 minus cost of planting material (napier) + planting material (*Setaria*)	55,500	*Setaria* cuttings	0.05	2775	33,545
T_4	T_1 minus cost of grubbing + Cost of spring shaving of *Saccharum* + cost of herbicide	40	Man days	70	2800	
	(0.75% Glyphosate)	3.75	Lts	400	1500	19,575
	+ Application	4	Man days	70	280	
T_5	T_4 minus cost of planting material (Napier) + planting material (*Cenchrus*)	55,500	*Cenchrus* root-slips	0.01	555	17,355
T_6	T_4 minus cost of planting material(napier) + planting material (*Setaria*)	55,500	*Setaria* cuttings	0.05	2,775	19,575
T_7	T_1 minus cost of grubbing + Cost of spring shaving of *Saccharum* + cost of herbicide	40	Man days	70	2800	
	(1.0% Glyphosate)	5.0	Lts	400	2000	20,075
	+ application	4	Man days	70	280	
T_8	T_4 minus cost of planting material(napier) + planting material(*Cenchrus*)	55,500	*Cenchrus* root-slips	0.01	555	17,855
T_9	T_4 minus cost of planting material (napier) + planting material (*Setaria*)	55,500	*Setaria* cuttings	0.05	2,775	20,075

Various expenditures incurred during the study were calculated on the prevailing market rates of different inputs

herbicidal treatments with reductions to the tune of 9.0 to 9.60 and 9.3 to 9.82 q/ha, respectively over its (*Saccharum*) initial fresh biomass of 116 q/ha. And per cent reduction of weed biomass ranged from 91.97 to 93.0 and 91.53 to 91.96, respectively. Similar findings were also reported by Thakuria and Singh (1990). The introduction of *Seteria* however did not show conspicuous reductions in fresh biomass yield of tiger grass as compared to napier and *Cenchrus* introductions.

Economics

The expenditure incurred in various treatments as innovative interventions as mentioned in Table 3 indicated that the herbicidal control of *Saccharum* proved itself to be economically superior as compared to the manual grubbing of the tiger grass irrespective of the agrostological interventions among various treatments. However the application of glyphosate 0.75% on the regenerated growth of spring shaved *Saccharum* followed by the planting of napier cuttings/*Cenchrus* rooted slips were found to be economically better with a net saving of about Rs. 500 and 13970 over all the others similar treatment combinations of 1.0% glyphosate as well as manual eradication, respectively. The results are in lines with Kumar and Sood (1998).

It is interesting to note that the introduction of improved grass species like napier and *Cenchrus* along with herbicide (glyphosate 0.75%) controlled tiger grass had a pronounced effect on the elimination of this hardy obnoxious weed. The present study envisages that the *Saccharum* infested river bed land pockets can be rejuvenated and converted successfully into highly productive pasture lands.

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