

Management of Vegetative Barriers Through Improved Technology in Submontaneous Tract of Punjab

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Abstract

To ascertain the performance of different grasses as vegetative barriers under dry land conditions an investigation was carried out with napier hybrid bajra (NHB), babbar, kana and vetivar. For three successive years, same set of treatment was established. The data revealed that the restoration of soil degradation (runoff and soil sediment loss) could be decreased effectively with management and conservation measures with plantation of different vegetative barriers. Among different grasses napier hybrid bajra gave significantly higher average fodder yield (411 q/ha) over the remaining grasses, thereby showing its best substitute to overcome the green fodder scarcity during lean period. Nitrogen applied at 100 kg/ha to different grasses NHB produced the highest fodder yield (633 q/ha) followed by kana (341 q/ha) > vetivar (264 q/ha) > babbar (127 q/ha). However, NHB significantly responded to 75 kg N/ha, which yielded maximum of 439 q/ha. As vegetative barriers these grasses reduced the runoff and soil sediment loss by 40–61% and 65–88% over control. The impact of these vegetative barriers was shown by the improvement of maize and wheat yield by restoring the soil fertility status.

Key words : Submontaneous tract, Napier hybrid bajra, Runoff, Sediment loss, Vegetative barriers.

The submontaneous tract of Punjab and the adjoining undulating piedmont plains in the south of Siwalik hills popularly known as *kandi* zone. The total area of this belt is 0.5 million hectares constituting about 10% of the geological area of the state. Although this belt has a distinct advantage of having higher rainfall than other parts of the state, because of topographical and lithological constraints, the irrigation in this zone are limited and most of the area is rainfed. The soils of this belt are located on slopping surface. With the condition that this zone is subjected to severe water erosion during rainy season and consequently soil fertility status decreases which can be checked with the successful cultivation of vegetative barriers. As a consequence, this belt is considered useful for growing of different vegetative barriers like napier hybrid bajra, babbar, kana and vetivar grasses which can perform better under dry land conditions. (1). As there does not exist huge possibilities of increasing agricultural production in the *kandi* region, pressure on production of different grasses to fulfill fodder requirement is also increasing. For this purpose napier hybrid bajra is suited fodder crop for animals. Little attention has so far been paid to monitor the performance of different grasses and their

utility as vegetative barriers and animal fodder. Vegetative barriers are narrow, parallel strips of stiff, erect and dense vegetation planned on or close to the contours. They reduce the velocity of runoff water, causing deposition of sediments on the upslope of the barriers. Over a period of years, barrier form terraces like benches (2). Among different grasses napier hybrid bajra has become by far the most important fodder due to its wide ecological range, high yield and ease of propagation. Napier hybrid bajra required 75 kg N/ha, 20 kg P/ha and 25 kg K/ha in one year. However, application of 5.5 ton FYM/ha leads to good grass yield (3). Napier hybrid bajra is heavy feeder and reduces the NO₃, Ca, Mg and K status of soil by uptake. Bayer (4) reported napier hybrid bajra was the best substitute of any other fodder in semi-arid and tropic region, whereas, Vincente et al. (5) reported the growth and fodder yield of napier bajra under different nutrition levels and revealed that maximum fodder yield of napier bajra could be achieved by frequency of cuttings and maintenance of proper nitrogen, phosphorus and potassium nutrients. Woodard and Prine (6) reported that the harvesting frequency differs with different genotypes of bajra. Sur and Sandhu (7) reported that maximum fodder

yield can be obtained from the four grasses like napier hybrid bajra, babbar, kanna and vetivar grasses under dryland conditions and also these are used as best check to reduce soil erosion.

Methods

Conventionally vetiver (*Vetivar zizanio*), kana (*Cynodon dactylon*), babbar (*Euloiopsis binata*) and napier hybrid bajra (*Saccharum munja*) were established in well drained soil from root splits. These grasses were planted in the loamy sand in texture with low fertility soils in July 1995 with onset of rains. The soil was low in available N and medium in available P and K. Also the soils are non-saline, non-sodic and generally low in organic matter content. The planted distance was 30 × 30 cm of vetiver and babbar and 60 × 60 cm of kana and napier hybrid bajra respectively. In each grass, three N levels were imposed (0, 50 and 100 kg N/ha). The planting distance was 30 × 30 cm for vetiver and babbar and 60 × 60 cm for kana and napier hybrid bajra, respectively. Both types of grasses and levels of N had significant influence on grass yield. With increase in the level of N, yield of grasses increased significantly except in babbar at lower N level.

Another experiment was conducted keeping in view that the napier hybrid bajra responses to nitrogen (N). The potential of hybrid bajra PBN 186 was studied at graded level of N on experimental farm of the station. Six levels of N (0, 25, 50, 75, 100 and 125 kg/ha) were applied before planting and after each cutting. The spacing between plant-to-plant and row-to-row was 60 cm. The planting was done with onset of monsoon in the first week of July 1995. First cutting was taken after 55 days.

Field experiment was also carried out to investigate the runoff and sediment loss of the soil. For this four vegetative barriers namely vetiver, babbar, kanna and napier were planted across the slope on the field boundaries in 1995 with 10 cm plant to plant spacing in two rows. One strip was kept as control (without vegetative barriers). Ramser samplers were installed and observations were recorded to study the effect of vegetative barriers on runoff and soil loss. Wheat and maize grain yield was also recorded to assess the effect of vegetative barriers on crop productivity.

Table 1. Relative performance of different vegetative barriers (q/ha).

Grasses	1st Year	2nd Year	3rd Year	Mean yield
Vetivar	9.5	24.5	102.4	45.5
Kana	16.8	25.6	120.5	54.3
Babbar	15.2	25.9	62.8	34.63
Napier bajra	309	354.5	569.7	411.3
CD (5%)	3.17	4.82	45.12	-

Results and Discussion

Biomass Yield of Different Vegetative Barriers

In the first year the biomass of all the three vegetative barriers (babbar, kanna and vetivar) was below average, whereas hybrid napier bajra yielded more than 300 q/ha. During the second year the yield of all the three vegetative grasses i.e. vetiver, kana and babbar was around 25 q/ha (Table 1). Whereas biomass yields of napier hybrid bajra in the second year was 354.5 q/ha. The results indicated that the cultivation of napier hybrid bajra could successfully be done for maximum biomass production. Also this crop has the potential to meet the fodder requirement of the farmers' upto reasonable extent. During this year of plant growth napier hybrid bajra recorded significantly highest grass yield (569.7 q/ha) followed by kana (120.5 q/ha), vetiver (102.4 q/ha) and babbar (62.5 q/ha). Similar results were reported by Sur and Sandhu (7) and Nakalevu et al. (8) under different climatic conditions.

Performance of Different Vegetative Barriers under Different N Levels

The mean yield of various vegetative grasses

Table 2. Response of different vegetative barriers to N levels (3-year mean).

Grasses	Gross weight of two cuttings (q/ha)			Mean
	N Levels (kg/ha)			
	0	50	100	
Babbar	112	122	147	127
Vetivar	213	263	316	264
Kana	284	344	419	349
Napier bajra	565	638	698	633
Mean	294	341	395	-
CD (5%) for	Grasses : 31.98 N levels : 21.2 Interaction: 42.4			

Table 3. Green fodder yield of napier hybrid bajra with N application.

N (kg/ha)	1st Year	2nd Year	3rd Year	Mean yield
0	75	171	411	219
25	91	346	536	324
50	113	409	784	435
75	136	399	783	439
100	137	393	726	419
125	127	410	719	419
CD (5%)	12.04	8.73	18.4	-

varied from 127 to 633 q/ha (Table 2). Vetivar grass produced 52% higher biomass yield than babbar grass, whereas kanna grass gave 32% more fodder yield than vetivar grass. Similarly, napier hybrid bajra yielded 81% higher green biomass over kanna grass. During third year of plant growth, the grass yield recorded from napier hybrid was the highest (633 q/ha) followed by kanna (349 q/ha), vetiver (264 q/ha) and babbar (127 q/ha). Application of 50 and 100 kg N/ha improved mean grass yield by 16.3 and 34.5%, respectively over control plot. The interaction between different grasses and nitrogen (N) was also significant. The results obtained by Grewal and Samra (9) were similar to the results reported from the study.

Biomass Yield of Napier Hybrid Bajra with N Fertilization

Because of its rapid growth and high yields napier hybrid bajra grass required regular application of nutrients (N). The highest biomass yields of napier hybrid bajra was obtained with different rates of nitrogen. Application of 25 kg N/ha after each cutting gave significantly higher biomass yield than that of no N treatment. Green fodder yield was significantly higher in both the years in the treatment receiving 50 kg N/ha than that of next lower dose (Table 3). Napier bajra did not show any significant response to higher doses of nitrogen. It is evident second and third year yields of napier bajra were 2–3 and 5–6 times higher than that of yield of first year crop respectively. Napier hybrid bajra is highly tolerant to drought conditions with the result that the adoption of this fodder crop is increasing fast compared to other grasses in the dry land areas of Punjab to meet the green fodder requirement. The fodder yield varied from 411 to 784 q/ha under various N treatments. Significantly highest bio-

Table 4. Effect of vegetative barriers on runoff, soil loss and crop yield.

Grass Barriers	Runoff (%)	Sediment Loss (t/ha)	Maize yield (q/ha)	Wheat yield (q/ha)
Control	36.72	37.30	32.60	12.00
Vetivar	17.77	9.12	41.40	13.90
Babbar	23.54	12.96	37.40	14.50
Kana	14.36	4.42	37.90	14.50
Napier bajra	22.40	11.65	39.80	12.20
CD (5%)	-	-	NS	NS

mass yield (435 q/ha) was obtained with 50 kg N/ha. The fodder yield obtained under 75, 100 and 125 kg N was lower than that of 50 kg N/ha. Woodard et al. (6), Sotomayor et al. (10), Dao et al. (11) and Vincente et al (5) reported similar results under different conditions.

Effect of Vegetative Barriers on Runoff, Soil Loss and Crop Yield

The vegetative barriers namely vetiver, babbar, kanna and napier were planted across the slope on the field boundaries checked the soil loss and runoff thereby affecting the grain yield of wheat and maize. One strip was kept as control (without vegetative barriers). In 1995, Ramser samplers were installed and observations recorded to study the effect of vegetative barriers on runoff and soil loss. The total runoff producing rain during the monsoon period was 92%. The runoff and soil loss was 40 to 61% and 65 to 88% less as compared to that of control, respectively (Table 4). Among the vegetative barriers the effectiveness in the control of runoff and soil loss was in the order: kana > vetiver > napier > babbar during 1995. The maize and wheat yields were higher in all the treatments as compared to control because of the reason that loss of nutrients through runoff is restricted. However the difference was non-significant. Similar observations were reported by Nakalevu et al. (8), Lindstrom et al. (12) and Gilley et al. (13) under different climatic conditions.

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