Range Mgmt. & Agroforestry 35 (1) : 22-26, 2014
ISSN 0971-2070

Establishment techniques of sewan (*Lasiurus sindicus* Henr.) grass in hot arid ecosystem of Rajasthan

K.C. Sharma

Central Sheep and Wool Research Institute, Arid Region Campus, Bikaner- 334 006 Rajasthan, India
Present address: Indian Agricultural Research Institute, Regional Station, Old Sehore Road, Indore ï 452 001, Madhya Pradesh, India
Corresponding author e-mail: kc_64sharma@yahoo.com
Received: 3rd October, 2013 Accepted: 22nd April, 2014

Abstract

The field experiment was laid out for two consecutive years during *Kharif* season of 2008 and 2009 at Bikaner, Rajasthan to find out the suitable and feasible technology for the establishment of sewan (*Lasiurus sindicus* Henr.) grass pastures and grasslands in hot arid ecosystem of Rajasthan. Results indicated that transplanting of nursery raised seedlings of sewan grass recorded maximum and significantly higher green fodder (12.23 and 13.56 t/ha), dry matter (4.52 and 5.10 t/ha) and crude protein (363.1 and 388.8 kg/ha) yields in both the years over all other methods of grass sowing or planting. The same treatment recorded highest values of energy ratio (8.86), energy productivity (492.1 g/MJ), net returns (Rs. 3558/ha) and B:C ratio (1.23). It was followed by soaked seed sowing method which recorded GFY 9.67 and 11.56 t/ha, DMY 3.58 and 4.35 t/ha, CPY 289.2 and 337.2 kg/ha in first and second years, respectively along with energy ratio (8.09), energy productivity (449.4 g/MJ), net returns (Rs. 2703/ha) and B:C ratio (1.20). Sowing of germinated seed and dry seed sowing in mud were found low productive and highly uneconomical for grass establishment. Though, net benefits recorded under pasture establishment may not be so attractive but looking to the difference in cost involved on establishment of perennial pastures in first year and decreased costs in subsequent years, makes it justified. Sewan grass sowing with seed pellet improved the soil fertility status especially organic carbon (%) and available N & K contents. Thus, for getting proper establishment, more productive, economical and energy efficient sewan grass pastures and grasslands, nursery raised seedling transplanting method should be adopted; whereas, in case of manpower crisis, soaked seed sowing method can be followed.

Keywords: Economics, Energy relationships, Establishment techniques, Fodder yields, Hot-arid ecosystem *Lasiurus sindicus*, Range grass

Abbreviations: B:C: Benefit: cost ratio; **CP:** Crude protein; **DMY:** Dry matter yield; **EC:** Electric conductivity; **FYM:** Farm yard manure; **GFY:** Green fodder yield; **OC:** Organic carbon; **SW:** Standard weeks

Introduction

The animal population of hot arid region is mainly dominated by grazing based small ruminants like sheep and goats, and their productivity is directly correlated with productivity and quality of native as well as developed pastures and grasslands. At present grasslands and pastures of the region are highly degraded due to over exploitation and these lands are dominated by inedible plant species like *Aerva pseudotomentosa*, *Laptadenia pyrotecnica, Crotolaria burhia etc*. Moreover, almost 40 per cent area of arid zone in Rajasthan is either under degraded pastures or under cultivable wastelands and have the scope for pasture rejuvenation and new establishment. This is of paramount importance and needs immediate attention to feed large animal population of the region. Among pasture grass species of the region, sewan (*Lasiurus sindicus* Henr.) is the most suitable perennial grass, having high palatability, good fodder quality, suitable for available land resource (undulated and sandy with low fertility) of the region and the most prominent drought resistance capacity to bear long dry spells. There are several traditional methods of grass establishment in practice in region for different situation *viz*., high and unstable sand dunes, where agricultural operations are difficult, inter-dunal lands, where seasonal water logging is common especially during rains. As a practical experience, pasture establishment through transplanting of nursery raised seedlings done by Urmul Setu Sansthan, Lunkaransar in villages of Lunkaransar tehsil of Bikaner district with sewan seed and guidance of CSWRI, ARC, Bikaner was found very successful method of grass establishment. Broadcasting of grasses seed pellets is a recommended method for grass establishment on high

sand dunes. But, planned research work on appropriate establishment technique of this grass is still meager. Keeping these all in view, present investigation was undertaken.

Materials and Methods

The field experiment was conducted during *Kharif* season of 2008 and 2009 at Research Farm of Central Sheep and Wool Research Institute, Arid Region Campus, Bikaner, Rajasthan. The Soil of the experimental site was sandy with pH 8.57 and EC 0.63 dS/m, having low organic carbon (0.24%), available nitrogen (158.4 kg/ha) and available phosphorus (8.54 kg/ha); and medium in available potassium (155.4 kg K/ha). Total 7 treatments consisted of dry seed sowing (T_1), soaked seed sowing (T_2), germinated seed sowing (T_3), seed pellet sowing (T_4), dry seed sowing in mud (T_5), rooted slips sowing (T_6) and nursery raised seedling transplanting (T_7) were tried in randomized block design with four replications. Sewan cultivar ‘CAZRI-M-33-5’ was sown at 50 cm apart rows except T_5, where broadcast sowing was done. Soaking of seed was done in fresh water for 12 hours (overnight) for T_2 and for 72 hours (three days) for T_7 as a treatment. Seed pellets were prepared by mixing seed, FYM, clay, sand and gypsum in 1:1:3:1:1 ratio for sowing in treatment T_4. For T_5 sowing water was filled in plots and mud was developed by feet. Rooted slips of grass were used from eight years old developed sewan grassland of same variety for planting in treatment T_6. Nursery raised grass seedlings of 40 days were used for transplanting under seedling transplanting treatment in treatment T_7. Plant to plant distance in rows was put 20cm under the treatment T_4, T_6 and T_7. A uniform dose of NPK @ 40 kg/ha to each plot was applied [N through urea (applied in two splits, half dose as basal and half after 30 days as top dressing), P through single superphosphate and K as muriate of potash at sowing]. The grass was sown/planted on 4th and 2nd July in first and second years, respectively and harvested once in first week of October in both the years. The second year trial was done in same field but place was changed to avoid the effect of previous year treatments and uproot of established grasses. Data on growth attributes, grass yield, plant samples for dry matter and chemical analysis; and soil samples were collected at harvest from each plot. Total tussocks in net plots were considered for calculation of number of tussocks per hectare, while tussock periphery at middle height of tussock at maximum width was taken for the estimation of tussock diameter. Treatment-wise soil samples of all the replications were mixed and analyzed for OC (%) and available N, P and K as per standard procedures. Energy relationships were computed as suggested by Devasenapathy *et al.* (2009). Economic viability was worked out on the basis of prevalent market prices of inputs and output. The total rainfall received during crop season of 2008 in different standard weeks (SW) was 4.4 mm in SW 28, 7.0 mm in SW 30, 98.5 mm in SW 31, 23 mm in SW 32 and 1.5 mm in SW 33 (134.4 in total 7 rainy days), while during 2009, 48.0 mm in SW 27, 86.0 mm in SW 28, 19.0 mm in SW 29, 53.0 mm in SW 30, 21.0 mm in SW 33, 24.0 mm in SW 35 and 17.8 mm in SW 36 (268.8mm in total 14 rainy days).

Results and Discussion

***Growth attributes and fodder yield*:** Data of two years revealed that treatment nursery raised seedlings transplanting recorded highest and significantly higher values of growth attributes *viz*., number of tussocks/ha, no. of tillers/tussock, tiller height (cm) and tussock diameter in both the years (Table 1), except no. of tussocks/ha, where differences in values recorded under seedlings transplanting and soaked seed method in 2008; and seedlings transplanting, soaked seed method, seed pellet and dry seed sowing during 2009 were statistically non-significant. These values were followed by seed soaked method of sowing and obtained values were also significantly superior to rest of the seeding and planting methods. Seedlings transplanting method was found instrumental in immediate establishment of grass and early pick up of growth parameters. Similarly, early initiation of germination and starting of growth under soaked seed method might be beneficial in observing greater values of growth attributes. It was also noted that dry seed sowing in mud and germinated seed sowing methods badly affected the germination, plant stand and growth of sewan grass, and recorded significantly lower values of all the growth attributes as compared to other treatments. Germination in bunch (more than one plant) at same place in seed pellet sowing might be affected the proper growth of grass and recorded lower values of growth attributes. While, poor survival per cent coupled with more time taken in establishment under rooted slips planting methods was observed the main reason in observing lower values of growth attributes. But, contrary to above, the root : shoot ratio values were maximum in dry seed sowing in mud on both fresh and dry weight basis due to better root development than above ground shoot growth.

Data on green fodder and dry matter yields indicated that transplanting of nursery raised seedlings provided significantly higher green fodder (12.23 and 13.56 t/ha) and dry matter (4.52 and 5.10 t/ha) yields in both the years over

all other treatments (Table 2). The extent of increase in green fodder and dry matter yields was to the tune of GFY 26.5, 35.6, 69.1 and 83.3 per cent; DMY 26.2, 32.2, 83.7 and 65.0 per cent in 2008; and GFY 17.3, 111.9, 23.9 and 20.6 percent, and DMY 17.2, 120.8, 27.2 and 21.1 per cent during 2009 over soaked seed, rooted slips, seed pellets and dry seed sowing methods respectively. Whereas, fodder yields obtained under dry seed sowing in mud and germinated seed sowing methods were only GFY 23.9 and 14.0 per cent; DMY 24.3 and 14.8 per cent in 2008, and GFY 15.1 and 15.9 per cent, DMY 13.9 and 13.7 per cent during 2009, respectively of yields recorded under seedling transplanting method. A higher grass yield under seedling transplanting and soaked seed method was the function of increased values of growth attributes *viz*., number of tussocks/ha, tillers / tussock, tiller height, and tussock diameter. These sowing methods were also recommended for sewan grass sowing by Singh and Gupta (1995), Sharma *et al*. (2006) and Yadav (1997). Lowest grass yields were produced under dry seed sowing in mud and germinated seed sowing methods due to lower values of tussock stands and other growth attributes, which significantly decreased the yields as compared to other treatments. Growing of more than one plant at same place under seed pellet sowing method also significantly reduced the values of growth attributes and resulted lower grass yield as compared with seedling transplanting, soaked seed and dry seed methods. In case of rooted slips method, lower survivability rates of tussocks in the treatment resulted in significantly lower grass yields than seedling transplanting, soaked seed, dry seed and seed pellet methods.

***Crude protein yield*:** Difference in crude protein (CP) content (%) under different treatments was non significant (Table 2), but CP yields varied significantly. Among treatments, seedling transplanting method recorded significantly higher CP yields over all other treatments. The extent of difference in CP yield was to the tune of 25.5 and 15.3 per cent higher from soaked seed method to 586.4 and 643.4 per cent more than germinated seed sowing method in both the years, respectively. The difference in CP yield was mostly because of variation in dry matter yields under different treatments.

***Energy relationships*:** Estimates of input and output energy; and calculation of energy ratio and energy productivity revealed that despite of maximum usage of input energy under rooted slips planting method, it recorded lower value of output energy than seedling transplanting, soaked seed method, dry seed sowing and seed pellet sowing methods. The higher usage of input energy in

Table 1. Growth attributes of sewan grass under different seeding and planting methods

Treatments	No. of tussocks in thousands/ha		No. of tillers / tussock		Tiller height (cm.)		Tussock diameter (cm.)		Root: Shoot ratio (Dry weight basis)		Root: Shoot ratio (Fresh weight basis)	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Dry seed	19.3	30.5	69.1	119.5	93.3	108.3	40.3	44.7	0.45	0.51	0.62	0.63
Soaked seed	22.2	31.7	77.5	123.6	105.4	109.4	46.8	46.2	0.49	0.50	0.63	0.63
Germinated seed	10.2	8.4	53.6	70.6	62.1	74.3	40.0	36.7	0.52	0.54	0.67	0.69
Seed pellet	17.2	31.2	66.0	114.5	90.2	101.2	36.5	41.5	0.47	0.49	0.60	0.62
Sowing in mud	9.7	6.9	66.5	59.4	62.9	77.1	36.5	33.1	0.57	0.65	0.74	0.75
Rooted slips	18.8	14.3	76.5	52.1	64.3	87.0	46.6	31.3	0.46	0.48	0.61	0.60
Seedlings transplanting	24.5	31.3	88.7	140.4	114.5	123.5	53.5	54.4	0.49	0.50	0.63	0.64
S Em±	1.03	1.56	3.69	5.38	3.26	4.01	2.44	1.53	0.02	0.03	0.03	0.04
CD (P=0.05)	3.08	4.64	10.96	15.98	9.36	11.91	7.25	4.55	0.05	0.08	0.09	0.11

rooted slips method was mainly because of more use of energy units in the form of rooted slips and manpower used in the planting, while lower value of output energy was the function of variation in dry matter yields. As an efficient energy efficient grass establishment method, seedling transplanting method recorded maximum values of energy ratio and energy productivity followed by soaked seed method (Table 3). The reason for greater values of energy ratio and productivity under seedling transplanting and soaked seed methods was mainly because of higher out put energy in the form of dry matter yields with proportionately lower usage of input energy.

***Soil fertility status*:** Mean data of two years on soil sample analyzed for OC (%), available N, P, and K indicated that sewan grass sowing with seed pellet had maximum values of all the nutrients except available P content, where maximum value was recorded with soaked seed sowing method (Table 3). Comparatively higher values of OC (%) and available N and K under seed pellet method of sowing might be due to addition of FYM and gypsum in the form of seed pellet, which increased the organic matter in soil, improved the biological activities of soil microbes and increased values of available soil nutrients. None of the other sowing or planting method of sewan grass was found instrumental in improving available nutrient status of soil.

Table 2. Green fodder, dry matter and crude protein yields of sewan grass under different seeding and planting method

Treatments	Green fodder yield (t/ha)		Dry matter yield (t/ha)		Crude protein content (%)		Crude protein yield (kg/ha)	
	2008	2009	2008	2009	2008	2009	2008	2009
Dry seed	7.23	11.24	2.74	4.21	8.0	7.6	220.8	319.7
Soaked seed	9.67	11.56	3.58	4.35	8.1	7.7	289.2	337.2
Germinated seed	1.71	2.16	0.67	0.70	7.9	7.5	52.9	52.3
Seed pellet	6.67	10.94	2.46	4.01	8.2	7.8	202.0	311.3
Sowing in mud	2.92	2.05	1.10	0.71	7.9	7.6	86.9	53.7
Rooted slips	9.02	6.40	3.42	2.31	7.9	7.4	269.3	170.7
Seedlings transplanting	12.23	13.56	4.52	5.10	8.0	7.6	363.1	388.8
S Em±	0.27	0.46	0.10	0.17	0.08	0.08	8.55	13.59
CD (P=0.05)	0.79	1.37	0.30	0.50	NS	NS	25.42	40.37

Table 3. Energy relationships, economics and fertility status of soil under different seeding and planting methods

Treatments	Energy relationships				Soil fertility status (kg/ha)	
	Input energy (MJ/ha)	Output energy (MJ/ha)	Energy ratio	Energy productivity (g/MJ)	OC (%)	Avail. N
Dry seed	8,796	62,460	7.10	395.6	0.26	161.3
Soaked seed	8,812	71,280	8.09	449.4	0.25	159.6
Germinated seed	8,827	12,240	1.39	77.0	0.23	158.2
Seed pellet	8,983	58,140	6.47	360.7	0.28	170.3
Sowing in mud	9,.097	16,200	1.78	100.0	0.23	153.9
Rooted slips	12,663	51,480	4.06	225.8	0.24	159.1
Seedlings transplanting	9,774	86,580	8.86	492.1	0.23	158.7

Treatments	Soil fertility status (kg/ha)		Economics			
	Avail. P	Avail. K	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
Dry seed	8.73	153.7	13,030	13,920	890	1.07
Soaked seed	8.93	152.9	13,137	15,840	2,703	1.20
Germinated seed	8.57	158.1	13,244	2,720	-10,524	0.20
Seed pellet	8.91	164.5	13,972	12,960	-1,012	0.93
Sowing in mud	8.78	156.7	13,237	3,640	-9,597	0.27
Rooted slips	8.53	159.5	14,926	11,440	-3,486	0.77
Seedlings transplanting	8.45	156.2	15,682	19,240	3,558	1.23

Labour wages ï Rs. 107/- manday and dry matter prices Rs. 4000/- per tonne

***Economics*:** Computation of net returns and benefit: cost (B:C) ratio (Table 3) showed that seedling transplanting method recorded highest values of net returns (Rs. 3,558/ ha) and B:C ratio (1.23) followed by soaked seed sowing method (Rs. 2,703/ha and 1.20). Higher net returns and B:C ratio with above sowing methods were due to more fodder productivity and economic benefits with proportionately lower use of money as compared to other treatments. Direct dry seed sowing of sewan grass ranked third and recorded net returns of Rs. 890/ha and B:C ratio 1.07. It is also to mention that net benefits recorded under pasture establishment may not be so attractive but looking to the difference in cost involved on establishment of perennial pastures in first establishment year and in subsequent years, makes it justified. In this context, negative values of net returns and less than 1 B:C ratios with seed pellet and rooted slips methods may be considered as per situation exists. Germinated seed and dry seed sowing in mud were found poor yielder and highly uneconomical methods of sewan grass sowing and recorded minus values of net returns (Rs. ï 10,514 and Rs. ï 9,627/ha) and B:C ratios (0.20 and 0.27).

Conclusion

Overall, it was inferred that for the establishment of new sewan pastures and grasslands in hot arid ecosystem, nursery raised seedling transplanting method holds promise to provide better grass establishment with higher energy efficiency and economical forage productivity, However, in the conditions of lower manpower availability, overnight soaked seed sowing method can also be followed for new establishment of grasslands and renovation of degraded pastures.

References

Devasenapathy, P., G. Senthilkumar and P. M. Shanmugam. 2009. Energy management in crop production. *Indian J. Agron.* 54(1): 80-89.

Sharma, K. C., S. C. Gill, J. S. Mann and V. K. Singh. 2006. Sewan ï a boon for livestock in hot arid region. *Technical Bulletin*, CSWRI, Avikanagar p. 31.

Singh, K.C. and J. P. Gupta. 1995. *Marushthaliya kshetron mein charagah vikas*. *Kheti* December issue pp. 45-46.

Yadav, M.S. 1997. Pasture Establishment Technique. In: *Silvipastoral Systems in Arid and Semi-arid Ecosystems* (Eds. M.S. Yadav, Manjit Singh, S.K. Tewari and U. Burman) CAZRI, Jodhpur pp. 193-195.