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Performance of improved forage species under dry temperate conditions of north western Himalayas

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Introduction

The dry temperate region of Himalayas is characterized by low precipitation, low temperature and high snowfall. In this region generally, all the areas excluding the intensively cultivated one are used as pasture and grasslands. The area is characterized by sloppy desert mountains with crop growing season of 5-6 months (April to September). In the region due to continuous heavy grazing and lack of management indigenous grass species presently represent the third or fourth stage of degradation. In north western Himalayas livestock plays a significant role in sustaining the livelihood of people, but in the region all forage resources are hardly enough to meet the forage requirement of even 40-50 per cent of the existing livestock population. Under this situation the planting of ecologically adaptable improved grasses and forage legumes appears to be a viable proposition to increase the forage production and availability in the region. Keeping in view this, the present study was undertaken to study the comparative performance of improved grasses and legume species under dry temperate climatic conditions.

Materials and Methods

A field experiment was conducted during summer 2005 and summer 2007 in the natural grassland conditions of north western Indian Himalayas at Research Sub-Station, Lari (Spiti Valley) of CSK HP Agriculture University, Palampur situated in dry temperate zone at 30° 42' N and 70° 37' E at an elevation of 3244 m amsl. The soil of the experimental site was sandy loam in texture, alkaline in reaction (pH 7.2), low in available nitrogen (216 kg/ha) and high in available phosphorus (34.6 kg/ha), potassium (480.3 kg/ha) and organic carbon (1.02%). The experiment was laid out in randomised block design with three replications comprised of nine treatments viz. no introduction of improved species i.e. local system; planting of orchard grass (*Dactylis glomerata* L.), tall fescue grass (*Festuca arundinacea* Schreb.), red clover (*Trifolium pratense* L.), lucerne (*Medicago sativa* L.), orchard grass + red clover, orchard grass+ lucerne, tall fescue grass + red clover and tall fescue grass+ lucerne. The experimental site was made free of weed by mechanical means and thereafter, improved forages species in sole stand were sown as per treatment through dibbling at a spacing of 30 cm x 30 cm. In mixed stand legumes were sown with grasses in additive intercropping series. The species were sown during May 2005 after the melting of snow in the valley. The season of 2005 was taken as the year of establishment and further two summer seasons of 2006 and 2007 were considered for data observation to draw the inference from the present study. The recommended dose of nitrogen (N), phosphorus (P₂O₅) and potassium (K₂O) was 40: 30:15 to local system, 60:60:30 to improved grasses & grasses +legumes and 30:60:30 to improved legumes.

Results and Discussion

Initial species composition of the experimental site: The experimental site was mainly dominated by weed species. The proportion of weeds was to the tune of about 63.8 per cent. *Artemisia sp.* was the major dominated weed in the area and was followed by the dominance of *Ephedra gerardiana*, *Astragalus himalayansis* and *A. candolleanus*. The presence of grass and legumes species was almost equal. Among grass species *Agrostis gigantean*, *Bromus gracillimus*, *B. inermis* were the dominated species and among legumes the *Melilotus alba* and *Medicago falcate* were dominant.

Green and dry fodder yields: The data on the performance of various species revealed that the planting of improved grasses and legumes either in sole or in mixed stand increased the forage production significantly over local system; however the magnitude of increase was variable with each treatment (Table 1). Datt *et al.* (2012) also reported significant improvement in herbage yield of temperate pastures with the planting of improved species. The data also indicated improvement in herbage production over the years in all the treatments except in red clover, where no increase in yield was noticed with progressive increase in time which indicated low persistency of red clover compared to other species. Among improved grasses tall fescue grass produced 74.47 per cent more green forage than orchard grass with respective increase of 104.81 per cent in dry forage owing to more dry matter content in tall fescue grass than orchard grass. Among legumes, lucerne produced 141.39 and 131.33 per cent more green and dry forage yields than red clover, respectively,

indicating better performance of lucerne with more dry matter content than red clover. The mixed stand of grasses comprised of lucerne as intercrop produced more herbage yield than their respective stands comprised of red clover as intercrop. Overall comparison of the treatments revealed that sole stand of lucerne produced significantly higher green and dry forage yields of 42.32 t/ha and 16.85 t/ha, respectively. Tall fescue grass + lucerne was the next best treatment producing 37.75 t/ha and 14.85 t/ha green and dry forage yields, respectively. This mixed stand of tall fescue grass and lucerne was followed closely by tall fescue grass + red clover and orchard grass + lucerne. Shah and Singh (1989) also reported good establishment, better competitive ability of introduced species with better yield in the existing grassland conditions. The increase in forage yield was minimum with the sole planting of orchard grass over local system.

Table 1. Effect of treatments on green and dry forage yield (t/ha)

Treatment	Green Forage				Dry Forage			
	2006	2007	Mean	% increase over local system	2006	2007	Mean	% increase over local system
Local system	13.37	19.73	16.55	-	5.63	7.43	6.53	-
Orchard grass	16.50	29.30	22.90	38.4	6.23	10.90	8.57	31.2
Tall fescue grass	21.47	33.80	27.64	67.0	8.50	12.90	10.70	63.9
Red clover	27.47	26.97	27.22	64.5	11.27	10.70	10.99	68.3
Lucerne	33.13	51.50	42.32	155.7	14.43	19.27	16.85	158.0
Orchard grass +red clover	22.70	37.87	30.29	83.0	10.40	14.47	12.44	90.5
Orchard grass+ lucerne	25.60	40.80	33.20	100.6	10.60	15.50	13.05	99.8
Tall fescue grass+ red clover	27.50	39.87	33.69	103.6	11.70	15.00	13.35	104.4
Tall fescue grass+ lucerne	29.80	45.70	37.75	128.1	12.40	17.30	14.85	127.4
CD (P=0.05)	7.74	2.38	5.06	-	3.46	1.40	2.43	-

Forage quality: Forage quality of various production systems have been quantified in terms of different parameters and mean of two years have been presented in Table 2. Planting of improved forage species influenced both desirable (crude protein, cellulose, hemi-cellulose and total ash) and undesirable (acid detergent fibre, neutral detergent fibre and silica) quality traits of the produce. Improved species produced the forage with better quality as evident from higher contents of nutritionally desirable parameters and low values of nutritionally undesirable parameters (Table 2). The contents of acid detergent fibre, neutral detergent fibre and silica were higher under local system. Higher values of crude protein content was noticed in sole legumes, and legumes in the mixed stand also contributed in increasing the crude protein content of the produce compared to sole stand of grasses. The values of nutritionally incriminating components like acid detergent fibre, neutral detergent fibre and silica decreased from 46.20 to 40.20, 68.35 to 60.58 and 2.79 to 2.14 per cent, respectively with the introduction of improved species.

Table 2. Quality parameter of forage as influenced by treatments

Treatments	Crude Protein (%)	Cellulose (%)	Hemi-Cellulose (%)	Total ash (%)	ADF (%)*	NDF (%)*	Silica (%)
Local system	8.55	19.60	20.25	7.08	46.20	68.35	2.79
Orchard grass	11.20	20.80	21.60	7.19	42.39	65.41	2.43
Tall Fescue grass	10.70	19.60	20.72	7.05	41.27	62.37	2.15
Red clover	18.45	20.65	21.36	7.15	41.98	60.58	2.14
Lucerne	18.17	21.45	24.51	7.40	40.51	62.50	2.16
Orchard grass +red clover	14.50	22.97	23.42	7.64	40.20	65.24	2.50
Orchard grass+ lucerne	13.41	23.25	24.68	7.95	43.21	66.50	2.65
Tall fescue grass+ red clover	13.28	21.50	22.50	7.62	42.86	65.15	2.45
Tall fescue grass+ lucerne	13.20	23.16	24.50	7.88	42.50	65.50	2.50

*ADF - Acid detergent fibre; NDF - Neutral detergent fibre

Conclusion

The study conclusively indicated that the productivity and quality of dry temperate grasslands in north western Himalayan region can be maintained on sustainable basis with the planting of ecologically adapted improved grasses and legumes. Tall fescue grass and Lucerne appeared most suitable species for the region.

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