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Exotic *Lolium perenne* Varieties: Their Forage Value and Soil Cover Potential in Himalayas Region

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Abstract: Rawalakot lies under humid temperate region at the height of 5500 ft from the sea level. The area is hilly and soils are prone to heavy erosion due to the loss of vegetative cover. Winter frost and snow often kills the local forages and thus depriving the livestock from green herbage altogether. Seven varieties of *Lolium perenne* (perennial ryegrass) from European and American germplasm were evaluated for their forage value and soil cover potential under Rawalakot conditions. All varieties compared were diploid (2n = 14). The comparison was based on plant height, fresh and dry matter yield, number of cuttings/ year and tillers plant^{-1}. The variety VA88002 was found to be the best one in plant height and dry and fresh herbage yield followed by SERVO and APUS. When tiller number was compared, the variety APUS was found to be at the top followed by VA88001 and others. All varieties were of spreading nature with increasing persistence in following years and found to be suitable for cutting, grazing and soil conservation.

Key words: *Lolium perenne*, fresh and dry matter yield, tillers, forage, soil erosion

Introduction

Grasses are the non-cereal members of the family Gramineae with about 10,000 important species (Hammad, 1995). These species provide an ideal nutritive and economic food for live stock and also improve the soil in terms of structure, water retention and productivity. Most of the hilly areas of Hindu Kush and Himalayan regions of Pakistan (about 45 to 62% of the total area) are classified as range lands. The local species of grasses are seasonal and only show their best biological potential during mon-soon season. During late fall, winter and early spring these grasses remain under dormancy and owing to the scarcity of green herbage the milk and meat yield of livestock reduced to the minimum level (Mahmood *et al.*, 1997).

Lolium perenne is the most common pasture grass in many temperate regions of the world. It is a long-lived perennial grass, capable of forming abundant leafy tillers with maximum succulence for grazing animals. The species is preferred over the other grasses due to its high digestibility, palatability and good tolerance to grazing (Frame, 1989). It can produce up to 11500 Kg ha^{-1} forage annually in 3-7 cuttings. Although *Lolium perenne* is less winter hardy yet it can withstand low temperature. It is highly nutritive and the weight gain in sheep fed on *Lolium perenne* has been found to be about 149 g/ day/ animal (Hammad, 1995).

Perennial grasses and legumes provide good forage to livestock and also ample cover to the soil against erosion. The densely tillering grasses like *Lolium perenne* greatly reduce the soil erosion (Elwell and Stocking, 1975) and also have good palatability and digestibility towards livestock. Similarly the *Lolium perenne* has extensive root system that binds the soil and hinder the flow of water with minimal soil loss. *Lolium perenne* root system is also known for the improvement of soil structure and the addition of organic matter contents in the soil (Elgersma, 1988).

Kashmir is low laying area of Southern Himalayas where most of the area is hilly with small bottom valleys. About 50 years ago more than 40% of the area was covered with forests (Ahmad and Chaudhry, 1995). Due to heavy grazing and injudicious deforestation desirable species of forest trees and grasses disappeared. The lack of cover made the soil vulnerable to erosion particularly during heavy mon-soon rains. The soil erosion depleted the mountain top cultivable soil and the soils were rendered marginalized. The heavy erosion in the area also damaged the water reservoirs like Mangla dam and cause siltation in canals and the water channels. The lower water storage capacity of the reservoir is of great concern with changing environment and the shortage of irrigational water as well as the hydral power (Ahmad and Chaudhry, 1995). Similarly the existing species/ varieties of grasses are very seasonal and provide green forage only during the mon-soon season. The cultivated lands are scarce (12-13%) and the agriculture has become uneconomical due to fragmentation of land with increasing population. The livestock production has good potential on steep slopes (range lands of about 45% of the total area) and marginalized land but the unavailability of perennial species of grasses and legumes hinder this option largely. In order to introduce better species of grasses and legumes, wide germplasm of forage grasses and legumes was collected and evaluated under local conditions of Rawalakot. The aim of the investigation was to identify the potential species/ varieties of the exotic grasses for year round green herbage availability for livestock farming and for soil cover to reduce soil erosion.

Materials and Methods

The seeds for different varieties of *Lolium perenne*, namely RIIKKA, VA88001, VA88002, VA88003, VALINGE, APUS and SERVO were originally collected from Nordic Gene Bank Sweden in 1992 and were maintained at the farm of University College of Agriculture Rawalakot Pakistan. The project was conducted during the years 1994 – 1995. The field was prepared and leveled before the sowing of seeds using Randomized Complete Block Design (RCBD). The data regarding plant height, number of tillers plant^{-1}, fresh weight/ plant and dry matter yield/ plant was recorded according to a similar method suggested by Mahmood *et al.* (1997), Carrow and Troll (1977) and Thomas (1984). The gap between two cuttings was maintained 60 days as suggested by Motazedian and Sharrow (1986). The data was plotted in bar diagramme for comparison using "Microsoft Excel".

Results and Discussion

Seven varieties of *Lolium perenne* were compared for different parameters (Table 1 and Figs. 1&2). Number of tillers produced by each variety in 1st and 2nd cuttings are

Table 1: Comparison of 7 *Lolium perenne* varieties under Rawalakot conditions

Varieties	No. of tillers plant^{-1}		Plant height		Fresh weight		Dry weight	
	1st harvest	2nd harvest	1st harvest	2nd harvest	1st harvest	2nd harvest	1st harvest	2nd harvest
APPUS	121.60	142.63	31.86	26.89	61.88	45.44	16.32	11.56
VA88002	118.48	104.25	32.32	29.79	54.11	43.57	13.57	10.00
VA88001	112.50	141.20	31.96	35.70	49.89	36.00	12.65	9.60
RIIKKA	105.74	118.14	37.93	33.93	45.64	29.00	11.43	8.43
SERVO	101.75	129.00	38.73	32.25	67.21	51.29	17.26	13.71
VA88003	100.67	151.50	40.33	34.10	76.33	54.00	18.61	11.80
VALIANGE	82.75	126.75	35.03	29.44	47.39	44.67	12.06	11.22

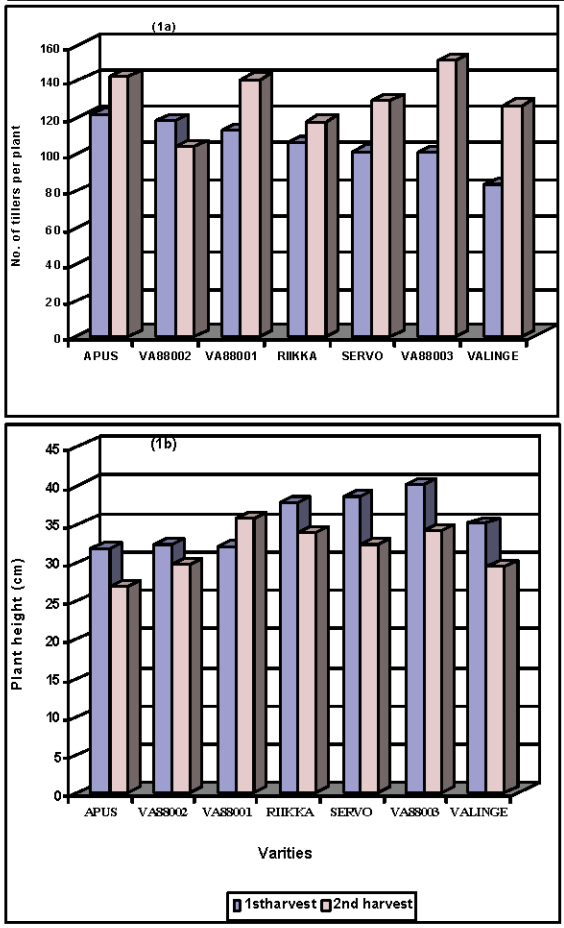

Fig. 1: Comparison of *Lolium perenne* on the basis of tillering capacity (a) and plant height (b) under Rawalakot conditions

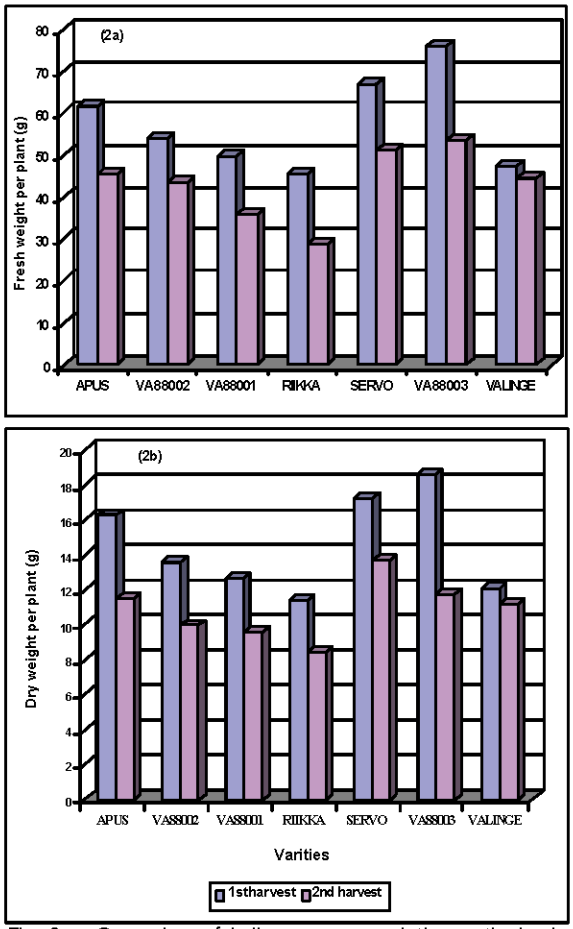

Fig. 2: Comparison of *Lolium perenne* varieties on the basis of fresh weight (a) and dry weight (b) under Rawalakot conditions

compared in Fig. 1a. The number of tillers among different varieties was found to be significantly different. It was observed that the number of tillers produced in each variety increased after 1st cutting in almost all varieties except one (VA88002). Similar trend was reported in a study (Mahmood *et al.*, 1997) when other such genotypes/ varieties of *Lolium perenne* were compared. The variety APUS performed better in both cuttings. However, its tiller number was lower than VA88003 in second cutting, which was at the lowest in firs cutting (Fig. 1a). The higher tillering capacity and the persistence of these varieties after each cutting would mean that the varieties have good grazing quality and soil cover potential against erosion (Elwell and Stocking, 1975). Fig. 1b indicates the plant height in two cuttings. The difference among varieties was again significant with variable performance in two cuttings. The figure shows similar trend in all varieties with greater plant height in 1st cutting compared to second cutting but one. The variety VA88001 deviates from the general trend, which was not understandable. The variety VA88003 stood first for the 1st cutting but VA88001 was found to be at the top in 2nd cutting. The negative trend in plant height compared with

tillers number will imply that with the increase in tiller number the height of plant has decreased. However, the biological yield potential seems to be constant in both parameters.

Fresh weight and oven dry weight /plant among different varieties is compared (Fig. 2a & 2b). The ratios were similar in both parameters with maximum fresh and dry weight in variety VA88003 and minimum in variety RIIKKA. The trend in all varieties was comparable in both cuttings. However, the variety VA88001 that was second to VA88003 in plant height and no. of tillers was found to be second lowest in fresh and dry weight values. This variation is quite different and need to be addressed further. On the basis of previous experience with grasses (Mahmood *et al.*, 1997 & Ahmad and Hasnain, 2001) it could be proposed that the variation was the result of low water contents and succulency of the variety. The hypothesis seems to be relevant in comparison to its lesser difference in dry and fresh weight value, which was largely variable in other varieties. The performance of different varieties in this experiment found to be related with the performance of other perennial grass varieties of *Lolium perenne* (Mahmood *et al.*, 1997) and *Festuca spp.* (Ahmad and Hasnain, 2001) examined under the similar conditions. The increased performance of varieties was also observed with persistent and spreading behaviour during the successive years. All varieties were found to be suitable for soil binding and soil holding purposes because of their extensive root system and soil cover potential. Such potential of *Lolium perenne* is well known and has been utilized elsewhere (Elwell and Stocking, 1975 and Elgersma, 1988). Similarly the nutritional value of the species and the preference of *Lolium perenne* over the other grasses is also very well established (Hammad, 1995). Such grasses need to be considered for cultivation in hilly areas of Pakistan, especially in the Himalayan region where the rainfall is not the limiting factor. The introduction of *Lolium perenne* in this region will therefore, help to control soil erosion as well as year round availability of the green herbage for the livestock.

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