# COMPARATIVE STUDIES ON WINTER RANGE GRASSES FOR THEIR FORAGE PRODUCTION

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**ABSTRACT:** Different cool season forage grass species viz: *Agropyron cristatum, Elymus wawawiensis, Festuca arundinacea, Lolium perenne, Poa pratensis* and *Puccinellia cilliata* were evaluated for their performance in Faisalabad. *Festuca* and *Lolium* species displayed 100% ground cover followed by *Puccinellia, Agropyron, Poa* and *Elymus* species which exhibited 95, 62.02, 48 and 18.17% ground cover, respectively. *Festuca* and *Lolium* species out yielded other species for forage production by producing 4.9 and 2.9 kg/m$^2$ average fresh green matter, respectively. whereas *Puccinellia, Poa, Agropyron* and *Elymus* species gave 1.35, 0.56, 0.45 and 0.06 kg/m$^2$ green matter, respectively. *Festuca arundinacea* was found best of all other species *Elymus wawawiensis* remained at the bottom during the trials in field.

## INTRODUCTION

The significance of range lands for Pakistan cannot be under estimated at any cost as these cover 40, 55, 60, 79, 30 and 45% areas of Punjab, Sindh, N.W.F.P., Balochistan, Northern areas and Azad Kashmir respectively (Quraishi *et al*., 1993) and provide 60% of the total feed requirement of sheep and goats, 40% of horses, donkeys and camels and 5% of cattle and buffaloes respectively (Mirza, 2007). Due to centuries long ago over use, lack of water, harsh climate, poor soils, the productivity of range lands is continuously declining and are presently producing only 10 to 50% of their potential (Quraishi *et al*., 1993, 1998, 2006, and Mirza, 2007).

In addition to these problems range lands of the country are also facing another major problem of range seasonality and are unable to provide fresh forage throughout the year (Quraishi *et al*., 2006). The seasonality is either due to low temperature or drought cum high temperature. Range livestock consequently regularly suffer from the scarcity of forage especially during winter and require emergency feed during such lean periods.

Quraishi *et al*., (2006) observed the fact that Pakistan native flora is dominated generally by summer grasses as compared to winter grasses and absence of winter growing grasses is considered a serious draw back of our vast range areas. It is dire need of the day that cool season/winter grasses must be tested. But no significant contribution was made by local researchers in this regard. Fortunately many research workers obsewhere reported the meritorious potential of some cool season winter grasses like *Agropyron cristatum, Festuca arundinacea, Lolium perenne, Poa pratensis* and *Puccinellia cilliata* (Donaghy *et al*. 2008, Conaghan *et al*. 2008; Khan *et al*. 2007; Su *et al*. 2007; Sinclair *et al*. 2006; Abraham *et al*. 2004; Wang and Huang 2004; Bonos *et al*. 2004; Callow *et al*. 2003; Virkajarvi, 2003; Wilkins and Humphreys, 2003; Gilliland *et al*. 2002; Kemp *et al*. 2001; Jiang and Huang, 2001; Lantinga *et al*. 2000; Jiang and Huang, 2000).

Keeping in view, the high national value of livestock sector constant supply of adequate amount of feed and green forage for ever increasing animal population is unavoidable (Virk *et al*. 2006; GOP, 2008). Winter range grasses can play a vital role in increasing the forage supply in the range areas of the country. But no novel attempt was made to explore the potential of cool season winter grasses in the prevailing local conditions of national range lands of the country. The aim of the present investigation is to find out such cool season grass species which may give high yield of nutritious forage during winter to overcome the chronic problem of acute shortage of forage for livestock in winter lean period due to range seasonality.

## MATERIALS AND METHODS

The experiment for the evaluation of different cool season winter grasses for their forage production was conducted at the experimental station of

Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad. Seeds of five cool season winter grasses viz. *Agropyron cristatum, Elymus wawawiensis, Festuca arundinacea, Lolium perenne* and *Poa pratensis* were obtained from regional plant introduction station, Washington State University, USA while seeds of *Punccinellia cilliata* was obtained from China. Experiment was laid out in randomized complete block design with 5 replications and measuring net plot size of 2.5 x 3.0 $m^2$. Seeds of all grasses were disease and endotype free. Seeds of all winter grasses were sown in last week of October in the polythene bags and transferred to field in mid of November, 1996. Each grass was harvested at the end of winter season during February, 1997.

**Seedling preparation:** For each grass seed. 1890 polythene bags were filled with silt loam soil and 3-4 seeds were sown in each bag. After 10 days, thinning was done and the best one seedling was retained in the bag and all other seedlings from each bag were discarded. Thus for 6 grasses, 11340 seedlings were prepared in 11340 polythene bags. Water was applied with the help of sprinkler and no extra water was allowed to stay in polythene bags. Subsequent waterings were applied whenever required. Moreover seeds were not disturbed during watering.

**Transplantation:** After 20 days of sowing and attaining the suitable size, seedlings of each grass were transplanted (shifted) to well prepared field plots where plant to plant and row to row distance was 15 cm whereas distance between last two plants of each line of each plot was 10 cm. Plots were irrigated with tube well water whenever required. Nitrogen and phosphorus were applied @ 160 and 65 kg/ha respectively. All phosphorus and half doze of nitrogen was applied at the time of seedling transplanting while remaining half nitrogen was applied after two months. While all the remaining area of the plot was considered as experimental area. Following data was collected at the end of vegetative growth stage of each grass.

- Percent ground cover
- Green matter yield
- Days to flowering

Cover and green matter yield (Forage production) of each cool season winter grass was measured and recorded by following the techniques as described by Quraishi (1992) whereas days to flowering were recorded when approximately 10% of the plants exhibited flowering in a particular species.

## RESULTS AND DISCUSSION

Statistical analysis showed the significant variance for percent ground cover and average green matter yield. The mean differences among *Festuca arundinacea, Lolium perenne and Puccinallia cilliata* were found statistically non-significant (Table-1).

**Percent Ground Cover:** Tall fescue (*Festuca arundinacea*) and rye grass (*Lolium perenne*) exhibited 100% ground cover in their respective plots whereas *Punccinellia ciliata* showed 95% ground cover followed by *Agropyron cristatum* and *Poa pratensis* which gave 62.02% and 48.00% ground cover respectively. *Elymus wawawiensis* was found on the bottom (18.17%) with respect to ground cover (Table-1 and Fig-1).

| Winter range grasses | Green matter yield ($kg/m^2$) | Percent ground cover |
|---|---|---|
| *Agropyron cristatum c* | 0.454 c | 62.02 b |
| *Elymus wawawiensis c* | 0.059 c | 18.17 d |
| *Festuca arudinacea a* | 4.890 a | 100.00 a |
| *Lolium perenne b* | 2.895 b | 100.00 a |
| *Poa pratensis c* | 0.556 a | 48.00 c |
| *Puccinellia cilliata bc* | 1.346 a | 95.00 a |
| *C.V. (%)* | 52.05 | 4.70 |
| *LSD (0.05)* | 1.609 | 6.033 |
| *LSD (0.01)* | 2.289 | 8.580 |

**Means sharing the same letter in a column do not different significantly at Ps 0.05**

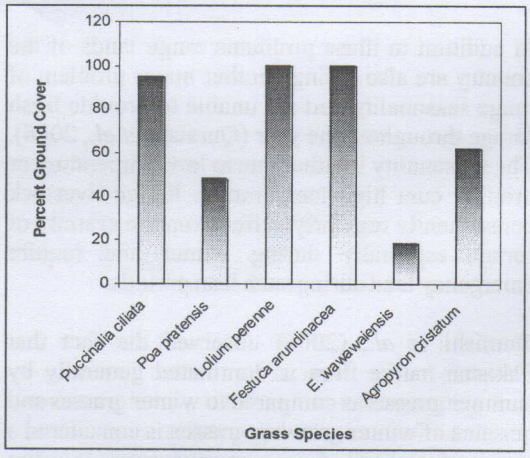


**Fig 1:- Percent ground cover of different cool winter grass species**

During the summer season only tall fescue and rye grass maintained their ground cover but plots were invaded by local summer weeds. *Lolium perenne* and *Festuca arundinacea* needed less hoeing due to their fast growth and dense ground cover. On the basis of the achieved results, these two species can be recommended for our range lands receiving rainfall in winter. *Punccinellia ciliata* can also be recommended for saline range areas.

During cool winter season, most of our range lands become almost bare due to low vegetation cover. Hence are subjected to wind and water erosion. This serious problem can be controlled only by introducing such species which may exert high percentage of ground cover with in short time. Grasses check and reduce soil erosion more effectively than other sources (Quraishi *et al.* 1993; Quraishi et al 2006).

**Green Matter Yield (Green Forage Production.):** Fresh green matter yield is considered one of the most important criteria for the selection of suitable grass species. For better output from range lands, high yielding species are needed which can exploit range potential more successfully. For this purpose, data regarding fresh green matter yield is presented by (Table-1 and Fig-2).

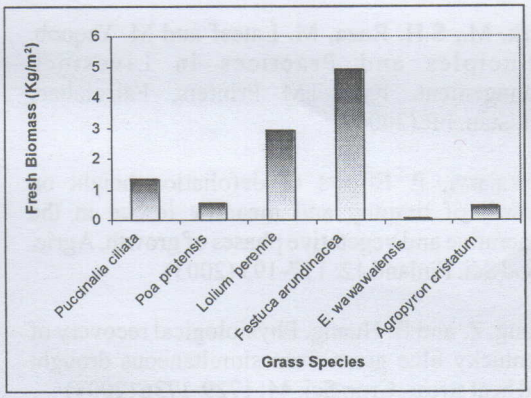


**Fig 2:- Average green matter yield (kg/m$^2$) of different winter grass species.**

Highest average fresh green matter yield was obtained from *Festuca arundinacea* i.e. 4.89 kg/m$^2$ (48.90 tons/ha) followed by *Lolium perenne* and *Puccinellia cilliata* with an average yield of 2.89 kg/m$^2$ (28.90 tons/ha) and 1.34 kg/m$^2$ (13.40 tons/ha) respectively. *Poa paratensis* and *Agropyron cristatum* went on fourth and fifth position by giving an average fresh green yield of 0.55 kg/m$^2$ (5.50 tons/ha) and 0.45 kg/m$^2$ (4.50 tons/ha) respectively, while *Elymus wawawiensis* gave the minimum yield (0.05 kg/m$^2$ ) on an average basis.

**Days to Flowering:** All greases did not flower during the study period except tall fescue and perennial rye grass flowered. Highest flowering was obtained in tall *Fescue* and *Lolium*, which was nearly 100% of the plants. All other species did not flower till the end of their growing season.

On the basis of fresh green matter yield (Fresh green forage production) it is suggested that *Festuca arundinacea* will be most suitable for range lands of Pakistan receiving rainfall during winter like northern Punjab and upland Baluchsitan. *Lolium perenne* will also be suitable for areas having less winter rainfall. *Puccinellia cilliata* may be recommended for range areas facing with the problems of salinity and high underground water table.

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