Phytology

Agro-morphological performance of ryegrass (*Lolium perenne* L.) in Jumla district of Nepal

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Abstract

A field experiment was conducted at research field of Sheep and Goat Research Program, Guthichaur, Jumla, Nepal during spring season from 18th March, 2018 to 25th July 2018 to evaluate the agro-morphological performance of ryegrass. Ten ryegrass genotypes were evaluated in randomized complete block design (RCBD) with three replications. Data were recorded for days to germination, plant height, leaf length, leaf width, no of tiller per plant and green biomass yield. The genotypes varied for days to germination and other agro-morphological traits. The genotypes HR prospect (43.8 t/ha), HR Marvei Rick (35.7 t/ha), and Base (35.7 t/ha) produced maximum green biomass yield. They were also found superior for growth, yield and yield attributing traits. The high amount of genotypic diversity increased the number of genotypes that may be chosen. According to the findings, superior perennial ryegrass genotypes could be used in future breeding programs.

Keywords: genotypes, adaptation, agro-morphological and green bio-mass

Introduction

Perennial ryegrass (*Lolium perenne L.*), also known as English ryegrass, is a cool-season perennial bunchgrass native to Europe, temperate Asia, and North Africa. Ryegrass is climate-resilient and highly nutritious fodder of the high mountains and widely distributed throughout the world, including North and South America, Europe, New Zealand, and Australia (Rolston *et al*., 2009) [10]. Perennial ryegrass is an important forage to avoid scarcity of forage in winter season at Karnali region. Parsons *et al*. (2011) [9] stated that vegetative persistence includes the survivorship of plants and the continued stability of dry matter yields of sown populations without reseeding. Malcolm *et al*. (2014) [5] showed that the significant cost savings associated with less frequent regrassing are realized if a cultivar maintains yields and survives longer. High palatability and digestibility make this species highly assessed for sheep and goat raising systems. Under the circumstances, it often is the preferred forage grass in temperate regions of the world. Owing to high yield potential, fast establishment, suitability for reduced-tillage renovation and also adopt in heavy waterlogged soils it gains a popularity. It is used primarily as a cost-effective pasture grass supporting the grazing requirements of beef cattle, dairy cows, sheep, and deer (White and Hodgson, 1999; Romera *et al*., 2017) [18, 11]). Panday and Upreti (2005) [8] mentioned that Perennial forages are major sources of green matter for animal diet. Shrestha (2005) [15] illustrated that due to uneven production and supply of perennial fodder the production and productivity of livestock goes down. Considering these facts, this experiment was conducted. The objectives of this study were to assess agro-morphological variation among ryegrass genotypes and to identify ideal genotypes for Karnali region.

Materials and Methods

The experiment was carried out at the research farm of Sheep and Goat Research Program, Guthichaur, Jumla, Nepal during spring season from 18th March, 2018 to 25th July 2018 to estimate adaptation and agro-morphological performance of ryegrass in Karnali region of Nepal. The field was located at 29.15^0N latitude, 82.2^0 E longitude and 2700 masl. The mean maximum temperature27.32ºC and minimum temperature -5.7ºC were recorded. Maximum temperature ranged from 22.16ºC to 32.4ºC. The minimum temperature ranged from -8.76ºC to 24.08ºC. Highest rainfall (755 mm) recorded during June- September 2018. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications consisting of ten ryegrass genotypes (Table 1). The individual plot size was 4 m^2 (8 rows of 2 m long) and spacing was 25 cm continuous. The soil texture was sandy loam and slightly acidic. The FYM @ 10 t/ha along with 80:60:40 kg N_2, P_2O_5 and K_2O/ha was applied in the experiments. Half nitrogen, full dose of phosphorous and potash was applied during sowing. Remaining dose of nitrogen is splitted into two parts and top dressed during 60 days after sowing and 90 days after sowing. Green biomass yield per hectare was deliberated by converting yield per plot into yield per hectare. The statistical package MSTAT-C was applied to analyze data (Russel and Eisensmith, 1983) [12]. Data was statistically analyzed according to RCB design, One-way ANOVA was used to analyze data. The means were separated by least

significance difference (LSD) at P<0.05 (Gomez and Gomez, 1984) [3].

Table 1: List of ryegrass genotypes used in the experiment

S. N	Name of Genotypes	S. N	Name of Genotypes
1	IR WS	6	IR Asset
2	CF Savvy	7	PR 150
3	CF Dhunche	8	HR Prospect
4	Base	9	PR Rely
5	HR marvei Rick	10	Dhunche

Results and Discussion

Table 2 revealed that Dhunche rye had the earliest in days to germination (15 days) followed by HR Marverick Rick (15 days), IR WS (15.33 days) and CF Dhunche had latest germination (17.33 days). Similarly, Base had manifested highest plant height (33.3 cm) and it was followed by HR Prospect (30.9 cm), HR Marverick Rick (128.3 cm) and IR Asset had least (13 cm). The genotype CF Savy had exhibited longest leaf length (22.13 cm) and it was followed by Base (21 cm), PR 150 (20.6 cm) and IR WS had shortest (16.6 cm). Similarly, PR Rely had highest leaf width (0.847cm) which was followed by CF Savy (0.73 cm), PR 150 (0.72 cm) and CF Dhunche had least (0.54 cm). In tillering the PR 150 had highest no of tillers per plants (37.5 tillers/plant) which was followed by Base (29.7 tillers/plant), Dhunche (26 tillers/plant) and IR WS exhibited least (18.6 tillers/plant). There was a highly significant and significant result exhibited in all four cuts of all genotypes. The experiment revealed that the highest green matter yielding genotype was HR Prospect in all four cuts (14.67 t/ha), (11.5 t/ha), (8.67 t/ha) and (9 t/ha respectively.

Table 2: Agro-morphological traits and yield of different ryegrass genotypes

Genotypes	Days to Germination	Plant Height (cm)	Leaf length (cm)	leaf Width (cm)	N of tiller Per Plant	Green biomass cutting yield (ton/ha)				Total biomass (t/ha)
						First cut	Second cut	Third cut	Forth cut	
IR WS	15.33	22.5	16.6	0.69	18.1	7.33	6.83	4.67	3.67	22.5
CF Savy	16.67	18.5	22.13	0.733	20.1	4.67	4	3	3.33	15
CF Dhunche	17.33	19	19.6	0.54	19.9	3.5	4.33	4.33	5	17.2
Base	15.67	33.3	21	0.68	29.7	12.33	10.33	6.67	6.33	35.7
HR marvei Rick	15	28.3	17.73	0.62	23.7	10.67	9.33	7.33	8.33	35.7
IR Asset	16	13	20.2	0.61	25.1	8	6.33	5	5	24.3
PR 150	17	20.2	20.6	0.72	37.5	11	8.67	6	5.33	31
HR Prospect	16.67	30.9	18	0.72	22.6	14.67	11.5	8.67	9	43.8
PR Rely	16.33	15	19.4	0.84	25.6	7.33	7	4.33	4	22.7
Dhunche	15	18.4	18.4	0.68	26	9.33	8.33	6.33	5.33	29.3
Grand Mean	16.1	21.9	19.38	0.687	24.8	8.88	7.67	5.63	5.53	27.7
CV%	10.2	40.4	21.6	22.1	33.7	37.7	38.3	44.5	43.4	35.5
F Value	0.646	0.147	0.86	0.54	0.28	0.019	0.091	0.28	0.13	0.044
$LSD_{0.05}$	2.819	15.17	7.19	0.26	14.3	5.74	5.037	4.29	4.12	16.88

Thus, this experiment suggested that HR prospect, HR Marvei Rick and Base are superior over other genotypes and will be promoted to release.

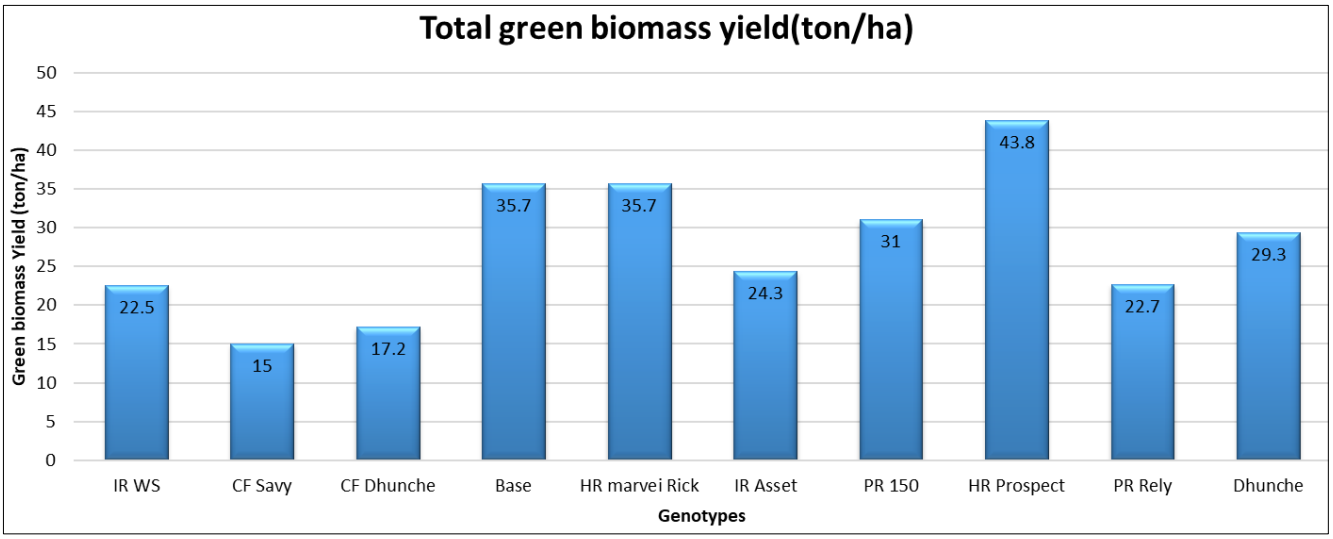

Fig 1: Total green biomass yield of genotypes

The figure 1illustrated the total green biomass yield of the genotypes. The genotype HR prospect exhibited highest green biomass yield (43.8 t/ha) which was followed by base (35.7 t/ha) and HR Marvei Rick (35.7 t/ha) and CF Savy had lowest (15 t/ha). In our study, there was a lot of diversity for these traits. The breeders' belief is that a large level of genetic diversity in a gene pool adds to variation, emphasizing the importance of selection (Acar *et al*., 2010) [1]. Previous research

on perennial ryegrass revealed similar variation in the examined characters (Elgersma, 1990; Tamkoc *et al*., 2009; Acar *et al*., 2010; Hammond *et al.*, 2011; Sampaux *et al*., 2012; Sun *et al*., 2012) [2, 17, 1, 4, 13, 16]. Plant heights in perennial ryegrass genotypes ranged from 19.35 to 48.05 cm (Ozkose and Tamkoc, 2014) [7] and from 30.0 to 106.0 cm (Ozkose and Tamkoc, 2014) [7]. (Acar *et al*., 2010) [1]. Beard (1973). Ozkose and Tamkoc (2014) [7] observed variation in leaf length, leaf width. They found many factors such as climate, agricultural practices and genotype affect leaf characters. The genotypes varied for green biomass yield. Similar result has been recorded in (SGRP, 2018) [14].

Conclusion

There were variations among the evaluated genotypes for days to germination and other agro- morphological traits. The genotypes HR prospect, HR Marvei Rick and Base are superior for agro-morphological characters; they produced maximum green biomass yield in all four cuts. Thus, these genotypes were regarded as promising genotypes for Karnali region of Nepal.

References

1. Acar Z, Ayan I, Tongel MO, Mut H, Basaran U. Morphological traits of perennial ryegrass accessions in Black Sea Region of Turkey. The contributions of grasslands to conservation of mediterranean biodiversity, April 7-10, Alicante-Spain, 2010, 117-120.
2. Elgersma A. Spaced-plant trait related to seed yield in plots of perennial ryegrass (*Lolium perene* L.). Euphytica 1990; 51:151-161.
3. Gomez KA, Gomez AA. Statistical procedures for agricultural research. A Willey- Inter Sci. Publication. John Willey and Sons, NewYork, 1984.
4. Hammond KJ, Hoskina SO, Burkeb JL, Waghornc GC, Koolaarda JP, Muetzela S. Effects of feeding fresh white clover (*Trifolium repens*) or perennial ryegrass (*Lolium perenne*) on enteric methane emissions from sheep. Animal Feed Science and Technology, 2011, 166-167, 398-404.
5. Malcolm B, Smith KF, Jacobs JL. Perennial pasture persistence: the economic perspective. Crop and Pasture Science 2014; 65:713-720. https://doi.org/10.1071/CP13419.
6. NPFRP. Annual Report of 2019/20. National Pasture and Fodder Research Program (NPFRP), NARC, Khumaltar, Lalitpur, Nepal, 2020.
7. Ozkose A, Tamkoc A. Morphological and agronomic characteristics of perennial ryegrass (*Lolium perenne* L.) genotypes. Turkish Journal of Field Crops 2014; 19(2):231-237.
8. Pandey SB, Upreti CR. Nutritional status of different feed resources of Nepal. Proceedings of the Workshop on Fodder Oats, Fodder Technology Packages and Small Farm Income Generation. March 8-11, 2005. Kathamndu, Nepal. Temperate Asia Pasture and Fodder Network FAO, 2005, 132-139.
9. Parsons AJ, Edwards GR, Newton PCD, Chapman DF, Caradus JR, Rasmussen S, *et al*. Past lessons and future prospects: plant breeding for yield and persistence in cool-temperate pastures. Grass and Forage Science 2011; 66:153-172. https://doi.org/10.1111/j.1365-2494.2011.00785.x.
10. Rolston MP, Mccloy BL, Harvey IC, Chynoweth RW. Ryegrass (*Lolium perenne*) seed yield response to fungicides: A summary of twelve years of field research. Foundation for Arable Research, New Zealand, 2009. https://www.researchgate.net/publication.
11. Romera AJ, Doole GJ, Beukes PC, Mason N, Mudge PL. The role and value of diverse sward mixtures in dairy farm systems of New Zealand: An exploratory assessment. Agricultural Systems 2017; 152:18-26. https://doi.org/10.1016/j.agsy.2016.12.004
12. Russel F, Eisensmith SP. MSTAT-C. *Crop and Soil Science Department*. Michigan State University USA, 1983.
13. Sampoux JP, Baudouin P, Bayle B, Be´guier V, Bourdon P, Chosson JF, *et al*. Breeding perennial ryegrass (*Lolium perenne* L.) for turf usage: an assessment of genetic improvements in cultivars released in Europe, 1974-2004. Grass and Forage Science 2012; 68(1):33-38.
14. SGRP. Annual Report of 2016/17. Sheep and Goat Research Program, NARC, Guthichaur, Jumla, Nepal, 2017.
15. Shrestha NP. Importance of different feed resources in livestock improvement in Nepal. Proceedings of the Workshop on Fodder Oats, Fodder Technology Packages and Small Farm Income Generation. March 8-11, 2005. Kathamndu, Nepal. Temperate Asia Pasture and Fodder Network FAO, 2005, 111-119.
16. Sun XZ, Waghorn GC, Hoskin SO, Harrison SJ, Muetzel S, Pacheco D. Methane emissions from sheep fed fresh brassicas (*Brassica spp*.) compared to perennial ryegrass (*Lolium perenne* L.). Animal Feed Science and Technology 2012; 176:107-116.
17. Tamkoc A, Ozkose A, Avci MA. Seedling characteristic perennial ryegrass (*Lolium perenne* L.) genotypes collected from natural flora. Türkiye VII. Field Crops Congress, 2009, 594-598.
18. White J, Hodgson JG. New Zealand pasture and crop science: Oxford University Press, 1999.