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Studies on Growth and Yield Performance of Different Varieties of Cool Season Forage Rye grass (*Lolium multiflorum* L.)

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Abstract

A field experiment was conducted during winter (Rabi) season of 2018-19 at R.B.S. College Agricultural Research farm, Bichpuri, Agra to assess the growth and yield performance of different varieties of cool season forage Rye grass (Lolium multiflorum L.) in randomized block design with four replications. The variables involved in this study were 15 varieties of Rye grass and berseem (T_1-Ribeys Diploid, T_2 – Doodh grass, T_3 – Maximum tetraploid, T_4 – BARLM 16167-1, T_5 – Hercules, T_6 – Berseem, T_7 – Jumbo Tetraploid, T_8 – BARLM 17168-2, T_9 – Makkhan grass, T_{10} – Malai grass, T_{11} – BARLM 17476, T_{12} – BARLM 17478, T_{13} – BARLM 17503, T_{14} – BARLM 17514, T_{15} – Barextra and T_{16} – E-grass). Results revealed that significantly higher values of most of the growth attributes as well as total green fodder yield was obtained with E-grass variety. At second, third and sixth cutting variety E-grass had higher green fodder yield than rest of the varieties. While at first and seventh cutting variety BARLM 17503 and at 4th cutting variety Doodh grass gave higher green fodder yield. As the dry fodder is concerned E-grass variety produced significantly higher total dry fodder yield and the second – best variety in this regard was Doodh grass. The highest net profit of Rs. 114062 ha^{-1} and B : C ratio 3.09 was received from E-grass and followed by Doodh grass which gave net return of Rs. 109452 ha^{-1} and B : C ratio 3.01.

Key words : E-grass, Fodder, Maximus Tetraploid, Yield

Introduction

In our country, the available forages are poor in quality, being deficient in available energy, protein and minerals. To compensate for the low productivity of the livestock, farmers maintain a large herd of animals, which adds to the pressure on land and fodder resources. There has been no change in the cultivated area under the forage production during the last two decades. The area under fodder crops in India is around 8.3 million ha. Sorghum amongst the *kharif* crops (2.6 million ha) and berseem amongst the *rabi* crops (1.9 million ha) occupy about 54% of the total cultivated fodder cropped area (Annual report, ICAR, 2020).

Rabi season forage crops are oat, berseem, lucerne, Rye grass, Red clover and forage sarson etc, which are commonly grown in India. Among *rabi* season forage crops of poaceae family Rye grass (*Lolium multiflorum* L.) is an important forage crops, which is an annual and perennial grass. It is native to Europe, Asia and Northern Africa, but is widely cultivated around the world. It contains approximately 10,000 species. Rye grass is an important pastures and forage crop. It has high digestibility and crude protein (56-85% and 8.0 – 27.7%) which makes it ideal for dairy and sheep forage system and it is particularly suitable for animal with nutrient requirement. Rye grasses are also used in soil erosion control programs. Annual Rye grass is best adapted to cool and moist climates. In cold areas annual Rye grass plays an important role in short term leys with high yields and quality. Annual Rye grass is compatible in mixtures with white clover.

Materials and Methods

Investigation entitled "Studies on Growth and Yield Performance of Different Varieties of Cool

Season Forage Rye Grass (*Lolium multiflorum* L.)" was carried out during *Rabi* season of 2018-19 under the department of Agronomy at Agricultural Research Farm, R.B.S. College, Bichpuri, Agra. The variables involved in this study were fifteen varieties of Rye grass and one berseem (Ribey Diploid – T_1, Doodh grass –T_2, maximus tetraploid–T_3, BARLM 16167-1-T_4, Hercules–T_5, Berseem–T_6, Jumbo teraploid–T_7, BARLM 16168-2-T_8, Makkhan grass–T_9, Malai grass–T_{10}, BARLM 17476–T_{11}, BARLM 17478-T_{12}, BARLM 17503-T_{13}, BARLM 17514–T_{14}, Barextra–T_{15} and E–grass–T_{16}). Thus, all the varieties were compared in a Randomized Block Design with four replications. The soil of experimental field was sandy loam in texture with pH 8.1. The soil was low in available nitrogen (179.00 kg ha^{-1}), medium in available phosphorus (27.50 kg P_2O_5 ha^{-1}) and rich in potash 288.70 kg K_2O ha^{-1}). During *Rabi* season of 2018-19, 116.2 mm rains were received.

Results and Discussion

The results obtained from the experiment are reported in Table 1 and 2 and discussed here under appropriate heads.

1. Growth parameters:

A perusal of Table 1 shows that, At 30 DAS, all the varieties of Rye grass were not appreciable among themselves. However, maximum number of shoots m^{-1} row length was recorded with E-grass (T_{16}). At 50, 70, 90, 110 and 130 DAS, E-grass (T_{16}) produced significantly higher number of shoots m^{-1} row length than rest of the varieties except BARLM 16167-1 (T_4), Berseem (T_6) and Malai grass (T_{10}). Higher number of shoots m^{-1} row length with E-grass variety might be held responsible to its genetic make up and favorable climatic conditions for crop period. Plants of E-grass variety were significantly taller when compared to other crops varieties except at 160 and 180 DAS. At 40 DAS, E-grass (T_{16}) produced appreciably taller plants than rest of the varieties except Doodh grass (T_2), BARLM 17167-1 (T_4), Hercules (T_5), Jumbo tetraploid (T_7), makkhan grass (T_9), Malai grass (T_{10}), BARLM 17476 (T_{11}) and BARLM 17514 (T_{14}). At 60 DAS, E-grass (T_{16}) had significantly taller plants than rest of the varieties except Doodh grass (T_2), Maximus tetraploid (T_3), BARLM 17514 (T_{14}) and Barextra (T_{15}). At 80 DAS, E-grass (T_{16}) produced appreciably higher taller

Table 1: No. of Shoots m^{-1} row length, Plant height (cm) and leaf: Stem ratio of different varieties of Rye grass

Treatments	Av. No. of Shoots m^{-1} row length	Av. Plant height (cm)	Leaf : Stem ratio at different growth stages			
			60 DAS	120 DAS	180 DAS	Mean
T_1	94.34	33.90	1.87	1.59	1.64	5.10
T_2	99.25	36.96	2.08	2.30	2.11	6.49
T_3	97.13	36.24	2.05	1.92	1.98	5.95
T_4	92.97	33.30	1.93	2.24	2.49	6.66
T_5	93.88	34.53	1.99	2.96	2.46	7.41
T_6	55.91	19.58	2.29	3.68	2.94	8.91
T_7	97.66	34.41	2.38	2.22	2.00	6.00
T_8	92.22	31.57	1.80	2.63	2.41	6.84
T_9	99.09	34.50	2.29	2.48	2.31	7.08
T_{10}	95.81	36.38	2.14	1.98	1.87	5.99
T_{11}	96.25	33.29	2.00	2.12	2.10	6.22
T_{12}	94.72	33.23	2.63	2.12	2.06	6.81
T_{13}	94.81	34.39	2.49	2.17	2.12	6.78
T_{14}	93.12	36.14	2.27	2.14	1.94	6.35
T_{15}	94.75	35.27	2.16	2.48	2.35	6.99
T_{16}	101.22	38.75	2.25	2.00	2.01	6.26
SEm±	2.38	2.27	0.179	0.143	0.141	1.80
CD (0.05)	6.78	5.57	NS	0.41	0.40	5.20

T_1 – Ribeys Diploid	T_5 – Hercules	T_9 – Makkhan grass	T_{13} – BARLM 17503
T_2 – Doodh grass	T_6 – Berseem	T_{10} – Malai grass	T_{14} – BARLM 17514
T_3 – Maximus Tetraploid	T_7 – Jumbo Tetraploid	T_{11} – BARLM 17476	T_{15} – Barextra
T_4 – BARLM 16167-1	T_8 – BARLM 16168-2	T_{12} – BARLM 17478	T_{16} – E–grass

plants than Doodh grass (T_2), maximus tetraploid (T_3), malai grass (T_5), BARLM 17514 (T_{14}), and Barextra (T_{15}). At 100 and 120 DAS, E-grass (T_{16}) had significantly taller plants than rest of the varieties except Doodh grass (T_2) in both the stages and malai grass (T_{10}) at 100 DAS. At 140 DAS, E-grass variety (T_{16}) had considerably more plant height than other varieties. At 160 DAS BARLM 17514 variety (T_{15}) had appreciably taller plants than rest of the cultivars, however, at 180 DAS Doodh grass (T_2) at par with Makkhan grass (T_{10}) and both had significantly taller plant than T_1, T_6, T_9 and T_{12}. All these varieties might be held responsible to its genetic make up and favourable climatic conditions for crop period.

In general leaf : stem ratio decreased with advancement in cutting frequency at all the varities of Rye grass except berseem (T_6). At 40 DAS makkhan grass (T_9) had maximum leaf : stem ratio than rest of the varieties of crop. Better adoption of makkhan grass with change of temperature might have exhumed leaf : stem ratio. At 60 DAS all the varieties did not well marked appreciably. At 80 DAS, Barextra (T_{15}) had significantly more leaf : stem ratio than other varieties except Dooth grass (T_2), Berseem T_6 and BARLM 17503 (T_{13}). Higher leaf : stem ratio with Barextra (T_{15}) might be due to change in temperature and more dry matter accumulation in stem. The present result in line with compliance with findings of white *et al.* 2012, Hancock, 2017 and Lin J *et al.,* 2018, White *et al.*, 2017.

2. Green Fodder yield:

The data on green fodder yield presented in Table-2 reveal that E-grass variety (T_{16}) was not differ significantly with doodh grass (T_2) but produced appreciably higher total green fodder yield than rest of the varieties. At first cutting, BARLM 17503 (T_{13}) had appreciably higher green fodder yield except berseem (T_6) and BARLM 16168-2 (T_8). Whereas, at second and third cutting E-grass variety (T_{16}) produced significantly higher green fodder yield than berseem (T_6) and BARLM 16168-2 (T_8) at second cutting and then berseem (T_6) at third cutting. At fourth cutting variety doodh grass (T_2) had considerably higher green fodder yield than rest of the varieties except E-grass (T_{16}) and then rest of the varieties at

Table 2 Total green fodder and dry fodder yield (Q ha^{-1}) and B : C ratio of various Rye grass varieties

Treatments	Av. green fodder yield (qha^{-1}) of eight cuttings	Av. dry fodder yield (qha^{-1}) of eight cuttings	B : C ratio
T_1	648.22	104.56	2.67
T_2	728.82	112.21	3.01
T_3	680.73	108.15	2.81
T_4	620.86	99.18	2.56
T_5	665.22	107.38	2.74
T_6	486.43	70.17	2.01
T_7	677.64	107.19	2.80
T_8	552.29	80.01	2.28
T_9	668.78	108.78	2.76
T_{10}	616.35	102.49	2.54
T_{11}	624.35	97.55	2.58
T_{12}	616.31	102.53	2.54
T_{13}	672.60	94.51	2.78
T_{14}	662.26	99.88	2.73
T_{15}	653.72	105.41	2.70
T_{16}	749.32	117.04	3.09
SEm±	17.06	3.26	-
CD (0.05)	48.58	9.30	-

T_1 – Ribeys Diploid	T_5 – Hercules	T_9 – Makkhan grass	T_{13} – BARLM 17503
T_2 – Doodh grass	T_6 – Berseem	T_{10} – Malai grass	T_{14} – BARLM 17514
T_3 – Maximus Tetraploid	T_7 – Jumbo Tetraploid	T_{11} – BARLM 17476	T_{15} – Barextra
T_4 – BARLM 16167-1	T_8 – BARLM 16168-2	T_{12} – BARLM 17478	T_{16} – E–grass

fifth cutting. At sixth cutting, E-grass (T_{16}) had appreciably more green fodder yield than T_6, T_8, T_{10} and T_{14}. Whereas, at seventh cutting BARLM 17503 (T_{13}) had significantly higher green fodder yield than T_1, T_2, T_3, T_6, T_8, T_{10} and T_{16}. At eight cutting, different varieties of crops did not differ appreciably among themselves.

Dry Fodder Yield:

The Table under reference (Table 2) indicates that E-grass (T_{16}) variety of Rye grass produced significantly higher total dry fodder yield than T_6, T_8, T_{10} and T_{12}. The second-best variety of Rye grass in this regard was doodh grass (T_2). The dry fodder yield at different cuttings was different. At first, second, third and fourth cutting E-grass variety (T_{16}) had significantly higher dry fodder yield than rest of the varieties except T_1, T_4 and T_7 at first cutting and T_2, T_3 and T_{10} at fourth cutting. At fifth cutting, doodh grass (T_2) has appreciably higher dry fodder yield than rest of the varieties. At sixth cutting Jumbo tetraploid (T_7) had considerably more dry fodder yield than other varieties except. T_1, T_5, T_8, T_{12} and T_{16} However, at seventh cutting, E-grass (T_{16}) had considerably higher dry fodder yield than rest of the varieties except (T_{15}). At eight cutting BARLM 17478 (T_{12}) had more dry fodder yield but at poor with BARLM 17503 (T_{13}) and makkhan grass (T_9) and rest of the varieties of Rye grass did not differ appreciably among themselves. These results are in corroboration with findings of Olson *et al.*, 2016, Forster *et al*. 2018, Lemus and White, 2016.

Conclusion

Significantly higher values of most of the growth attributes as well as total green fodder yield was obtained with Rye grass variety E-grass. At second, third and sixth cutting variety E-grass had higher green fodder yield than rest of the varieties. While at first and seventh cuttings variety BARLM 17503 and fourth cutting variety doodh grass gave higher green fodder yield. As the dry fodder is concerned E-grass variety produced significantly higher total dry fodder yield and the second best variety in this regard was doodh grass.

The highest net profit of Rs. 114062 ha^{-1} and B : C ratio 3.09 was received from E-grass and followed by doodh grass which gave net return of Rs. 109450 ha^{-1} and B : C ratio 3.01.

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