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Performance of Makhangrass (*Lolium multiflorum*) under Various Seed Rate in South East Rajasthan, India

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A B S T R A C T

A field experiment was conducted during two consecutive years from 2014-15 and 2015-16 at Agricultural Research Station, Kota, entitled "Performance of Makhangrass (*Loliu multiflorum*) under various seed rate in South East Rajasthan. Sowing of makhangrass with 14 kg seed/ha gave significantly higher green fodder yield (879 q/ha) and dry fodder yield (178 q/ha) over berseem sowing (25.0 kg seed/ha) by giving green fodder yield (690 q/ha) and dry fodder yield (142 q/ha). However, sowing of makhangrass with 13.0 and 15.0 kg seed/ha were at par with each other but it was found significantly superior over 12.0 and 16.0 kg seed/ha.

Introduction

Makhangrass (*Loliummultiflorum* Lam.), also called *Italian ryegrass*) is a cool season annual bunchgrass native to southern Europe. It is closely related to perennial ryegrass (*Lolium perenne* L.). Both are widely distributed throughout the world, including North and South America, Europe, New Zealand, and Australia. Makhangrass is an important short duration grass. High palatability and digestibility make this species highly valued for forage. It is used in many environments when fast cover or quick feed is required. Characteristics include: High yield potential, fast establishment, suitability for reduced-tillage renovation and use on heavy and waterlogged soils (Rana *et al*., 2013).

The agriculture and livestock sector provides employment to 52 per cent of the work force. Even being highest livestock population (529.7 million) in India (Anonymous, 2011-12), supporting nearly 20 per cent of the world livestock and 16.8 per cent human population on a land area of only 2.3 per cent, India faces a net deficit of 62.7 per cent green fodder, 21.9 per cent dry crop residues and 64 per cent feeds. During 2010, supply of green forages and roughages was 395.2 and 451 million tonnes against the demand of 1061 and 589 million tonnes, respectively (ICAR, 2012). Makhangrass is highly nutritional multicut, highly succulent and the most palatable grass in the World. Makhangrass feeding will greatly improve milk production

and quality (especially milk solids), it is considered to be one of the highest quality winter forages utilized in the World. Dry matter digestibility is generally greater than 65 per cent, and crude protein content exceeds the requirements for most classes of livestock animal gains.

Among crop management practices seeding densities or plant population greatly affect crop growth and then finally yield. Therefore seeding density is a key factor in assessing the flexibility and yielding ability of cultivars. Both over and substandard plant population is the major cause of low yield (Jan *et al.*, 2000). Optimum seed rate plays an important role in contributing to the high yield because in case of thick plant population, most plants remain sterile, easily attacked by diseases as compared to normal population Robert and Singh (1981).

Whether by mechanical clipping or grazing, defoliation management greatly influences forage quality, productivity, and persistence. Quality is most affected by maturity stage at harvest. To obtain high quality preserved forage (silage or hay), harvest annual makhangrass at the boot stage. For silage, let plants wilt prior to ensiling and lower moisture content will reduce effluent losses from silage. In the India, three to four cutting are possible, typical yield distribution is 30-35 percent in the first cutting, 35-40 percent in the second cutting and 20-25 percent in subsequent cutting. More consistently high quality forage is obtained by grazing, green chopping and ensiling early spring growth to stimulate recovery growth, fertilize with nitrogen immediately following the initial cutting (Smith *et al.*, 2005).

Materials and Methods

Experiment was conducted during two consecutive years from 2014-15 and 2015-16 at Agricultural Research Station, Kota. The experimental field was well prepared by two ploughing followed by harrowing and cultivator and one planking for uniform leveling were performed for sowing of makhangrass. The experiment was laid-out in Randomized Block Design with four replications having six treatments *i.e.* T_1: Makhangrass (seed rate 12 kg/ha), T_2: Makhangrass (seed rate 13 kg/ha), T_3: Makhangrass (seed rate 14 kg/ha), T_4: Makhangrass (seed rate 15 kg/ha), T_5: Makhangrass (seed rate 16 kg/ha) and T_6: Berseem (seed rate 25 kg/ha) control.

The bulk density, pH and cation exchange capacity of these soils varies between 1.30-1.60 Mg/m^3, 7.75-8.50 and 30-40 Cmol/kg, respectively. The soils of the region are poor in organic carbon (0.50±0.08) and available nitrogen (275±5 kg/ha) but are low to medium in available P_2O_5 (24.2± 1.0 kg/ha) and medium to high in available K_2O (290 ± 8 kg/ha). The recommended dose of nitrogen, phosphorus and potash *i.e.*150 kg N/ha, 60 kg P_2O_5 / ha and 60 kg K_2O /ha was applied through urea, di-ammonium phosphate (DAP) and muriate of potash (MOP), respectively. Full dose of DAP and MOP and 50 kg N were drilled just before sowing and remaining nitrogen were applied in three split doses at 30,50 and 80 DAS.

Results and Discussion

Plant population

Pooled data shows that, the plant population of makhangrass significantly influenced by sowing of different seed rate (Table 1).

Significantly higher plant population (6,72, 625/ha) of makhangrass was recorded with the sowing of 16 kg seed/ha which was significantly superior over sowing of makhangrass with different seed rate and berseem sowing with 25 kg seed/ha.

I[st] cutting

Pooled data shows that the growth parameters of makhangrass significantly influenced by sowing of different seed rate (Table 1). Significantly higher plant height (40.62 cm) and leaf weight/10 plants (29.07g) of makhangrass were recorded with the sowing of 12 kg seed/ha over sowing of makhangrass with 13, 14, 15 and 16 kg/ha seed rate and berseem sowing with 25 kg seed/ha, respectively. The maximum stem weight/10 plants (17.30 g) was recorded with the sowing of makhangrass by 12 kg seed/ha but it was found at par with sowing of makhangrass 13 kg seed/ha over sowing of makhangrass with different seed rate and berseem sowing with 25 kg seed/ha. Fodder yield was significantly influenced by sowing of different seed rate of makhangrass (Table 1). Pooled data of two years shows that the sowing of makhangrass with 14.0 kg seed/ha was observed to provide maximum green fodder yield (305 q/ha) and dry fodder yield (62 q/ha) which was significantly superior to berseem sowing (25 kg seed/ha) having green fodder yield (210 q/ha) and dry fodder yield (43q/ha). However, sowing of makhangrass with 15.0 and 16.0 kg seed/ha were statistically non significant. These results are in close proximity with those of Smith *et al.,* (2005) and Rana *et al*., (2013).

II[nd] cutting

During II[nd] cutting growth parameters were significantly influenced (Table 2) by sowing of different seed rate of makhangrass. Pooled data of two years show that the maximum plant height (44.88 cm) was recorded with the sowing of berseem (25.0 kg seed/ha) over sowing of makhangrass with different seed rate. Significantly higher leaf weight/10 plants (30.6 g) with the sowing of makhangrass 12.0 kg seed/ha over sowing of makhangrass with different seed rate and berseem 25 kg seed/ha, respectively. The maximum stem weight/10 plants (23.80 g) was recorded with the sowing of berseem (25.0 kg seed/ha) over sowing of makhangrass with different seed rate. Fodder yield was significantly influenced by sowing of different seed rate of makhangrass (Table 2). Pooled data of over two years shows that the maximum green fodder yield (363 q/ha) and dry fodder yield (73 q/ha) were recorded under sowing of makhangrass 14.0 kg seed/ha but it was found at par with the sowing of makhangrass 15.0 kg seed/ha over different seed rate of makhangrass and berseem sowing with 25.0 kg seed/ha. Similar results indicated by Smith *et al.,* (2005), Rana *et al.,* (2013) and Prajapati *et al*., (2017).

III[rd] cutting

Plant growth was significantly influenced (Table 3) by sowing of different seed rate of makhangrass. The maximum plant height (35.1cm) and leaf weight/10 plants (25.5 g) of makhangrass were recorded with the sowing of 12.0 kg seed/ha over sowing of makhangrass with different seed rate and berseem sowing with 25 kg seed/ha, respectively. Significantly higher stem weight (14.56 g) was observed with the sowing of makhangrass 12.0 kg seed/ha over different seed rate of makhangrass and sowing of berseem with 25.0 kg seed/ha. However, it was found at par with sowing of makhangrass 13.0 kg seed/ha. Makhangrass fodder yield was significantly influenced by sowing of different seed rate (Table 9). The pooled data shows that the significantly higher green fodder yield (211 q/ha) and dry fodder yield (42 q/ha) were recorded sowing of makhangrass by 14.0 kg seed/ha over sowing of makhangrass by 12.0 and 16.0 kg seed/ha and berseem sowing with 25.0 kg seed/ha. However, it was found at par with sowing of makhangrass by 13.0 and 15.0 kg seed/ha, respectively.

Table.1 Effect of different seed rate on plant population, growth and fodder yield of makhangrass (Ist cutting)

Treatments	Plant population (thousand/ha)			Plant height (cm)			Weight of leaves/10 plants (g)			Weight of stem/10 plants (g)			Green fodder yield (q/ha)			Dry fodder yield (q/ha)			
	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	Dry matter (%)
Seed rate 12 kg/ha	522500	522520	522510	40.50	40.75	40.62	29.00	29.15	29.07	17.25	17.35	17.30	259	261	260	52	53	53	20.38
Seed rate 13 kg/ha	565000	565233	565117	37.75	37.93	37.84	27.50	27.36	27.43	16.25	16.38	16.31	289	295	292	60	61	61	20.89
Seed rate 14 kg/ha	610000	610278	610139	36.50	36.65	36.57	26.75	26.91	26.83	14.75	14.86	14.80	304	306	305	62	64	63	20.65
Seed rate 15 kg/ha	630000	630250	630125	35.75	35.95	35.85	26.00	26.15	26.07	14.00	14.13	14.06	294	297	295	61	63	62	21.01
Seed rate 16 kg/ha	672500	672750	672625	29.25	29.41	29.33	22.25	22.40	22.32	13.00	13.14	13.07	290	292	291	57	60	59	20.27
Berseem 25 kg/ha	595000	596500	595750	38.00	38.19	38.09	7.63	7.88	7.75	9.50	9.64	9.57	209	212	210	42	43	43	20.47
SEm ±	4916	5019	4570	0.55	0.53	0.49	0.56	0.51	0.48	0.58	0.55	0.51	5.08	4.51	4.41	0.91	0.87	0.81	-
CD at 5 %	14806	15118	13773	1.65	1.61	1.52	1.70	1.55	1.50	1.76	1.67	1.56	15.30	13.59	13.29	2.73	2.63	2.46	-

Table.2 Effect of different seed rate on growth and fodder yield of makhangrass (IInd cutting)

Treatments	Plant height (cm)			Weight of leaves/10 plants (g)			Weight of stem/10 plants (g)			Green fodder yield (q/ha)			Dry fodder yield (q/ha)			
	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	Dry matter (%)
Seed rate 12 kg/ha	43.75	44.00	43.88	30.75	30.49	30.6	20.25	20.35	20.3	319	321	320	64	65	65	20.31
Seed rate 13 kg/ha	41.25	41.55	41.40	28.50	28.75	28.6	18.55	18.81	18.7	346	350	348	69	72	71	20.40
Seed rate 14 kg/ha	40.25	40.33	40.29	27.75	27.99	27.9	17.50	17.62	17.6	361	364	363	72	73	73	20.11
Seed rate 15 kg/ha	39.25	39.28	39.27	27.25	27.50	27.4	17.00	17.10	17.1	349	351	350	70	72	71	20.28
Seed rate 16 kg/ha	31.75	31.80	31.78	23.25	23.50	23.4	15.00	15.13	15.1	337	339	338	67	67	67	19.82
Berseem 25 kg/ha	46.00	43.75	44.88	10.63	10.86	10.7	23.75	23.87	23.8	318	320	319	65	66	66	20.68
SEm ±	0.52	0.48	0.46	0.48	0.48	0.44	0.56	0.49	0.48	5.72	5.16	5.00	1.09	1.03	0.97	-
CD at 5 %	1.57	1.45	1.38	1.46	1.44	1.33	1.68	1.48	1.45	17.23	15.54	15.08	3.30	3.10	2.93	-

Table.3 Effect of different seed rate on growth and fodder yield of makhangrass (IIIrd cutting)

Treatments	Plant height (cm)			Weight of leaves/10 plants (g)			Weight of stem/10 plants (g)			Green fodder yield (q/ha)			Dry fodder yield (q/ha)			
	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled	Dry matter (%)
Seed rate 12 kg/ha	35.00	35.20	35.1	25.00	26.00	25.5	14.50	14.61	14.56	157	158	158	31	32	32	20.25
Seed rate 13 kg/ha	32.75	32.98	32.9	21.75	21.96	21.9	14.25	14.35	14.30	200	201	201	39	40	40	19.90
Seed rate 14 kg/ha	31.50	31.71	31.6	21.00	21.22	21.1	13.00	13.13	13.07	210	212	211	41	42	42	19.90
Seed rate 15 kg/ha	30.75	30.96	30.9	19.50	19.73	19.6	12.25	12.38	12.32	202	204	203	40	41	41	20.19
Seed rate 16 kg/ha	26.00	26.20	26.1	18.50	18.74	18.6	10.75	10.86	10.81	190	189	190	38	39	39	20.52
Berseem 25 kg/ha	30.00	33.05	31.5	6.50	6.75	6.6	7.50	7.63	7.57	161	161	161	32	33	33	20.49
SEm ±	0.57	0.53	0.50	0.34	0.28	0.28	0.41	0.38	0.39	4.66	4.44	4.18	0.77	0.83	0.73	-
CD at 5 %	1.73	1.60	1.52	1.01	0.83	0.85	1.24	1.15	1.19	14.05	13.39	12.61	2.32	2.51	2.21	-

Table.4 Mean green and dry fodder yield of Makhangrass during Ist, IInd andIIIrdcutting

Treatments	Green fodder yield (q/ha)				Dry fodder yield (q/ha)			
	Istcutting	IInd cutting	IIIrd cutting	Total	Istcutting	IInd cutting	IIIrd cutting	Total
Seed rate 12 kg/ha	260	320	158	738	53	65	32	150
Seed rate 13 kg/ha	292	348	201	841	61	71	40	172
Seed rate 14 kg/ha	305	363	211	879	63	73	42	178
Seed rate 15 kg/ha	295	350	203	848	62	71	41	174
Seed rate 16 kg/ha	291	338	190	819	59	67	39	165
Berseem 25 kg/ha	210	319	161	690	43	66	33	142
SEm ±	4.41	5.00	4.18	-	0.81	0.97	0.73	-
CD at 5 %	13.29	15.08	12.61	-	2.46	2.93	2.21	-

General View of Experimental plot

These results are in close proximity with those of Joshi *et al*., 2005 and Prajapati *et al*., 2017.

In conclusion, the results of the field experiment entitled "Performance of makhangrass (*Lolium multiflorum*)" indicated that sowing of makhangrass using 14.0 kg seed/ha appear to be beneficial for obtaining higher green and dry fodder yield. Sowing of makhangrass with 14 kg seed/ha gave significantly higher green fodder yield (879 q/ha) and dry fodder yield (178 q/ha) over berseem sowing (25.0 kg seed/ha) by giving green fodder yield (690 q/ha) and dry fodder yield (142 q/ha).However, sowing of makhangrass with 13.0 and 15.0 kg seed/ha were at par with each other but was found significant over 12.0 and 16.0 kg seed/ha. Makhangrass may be suitable for green fodder purpose in winter season.

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