Original Research Article

Response of Different Seed Rate on the Productivity of Hybrid Fodder Sorghum (Sugar graze) in South East Rajasthan

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Abstract

A field experiment was conducted during two consecutive years from 2014 and 2015 at Agricultural Research Station, Kota. Significantly higher green fodder yield (907 q/ha) and dry fodder yield (245 q/ha) were observed with sowing of Sugargraze by 9.5 kg seed/ha over local chari sowing by 10.0 kg seed/ha green fodder yield (668 q/ha) and dry fodder yield (168 q/ha). However, it was found at par with sowing of Sugargraze by 7.5 kg seed/ha green fodder yield (896 q/ha) and dry fodder yield (242 q/ha).

Keywords

Sugargraze, Seed rate and Fodder yield.

Introduction

Sorghum [Sorghum bicolor (Linn.) Moench] is an important crop in the world, used for food (as grain or sorghum molasses), fodder, the production of alcoholic beverages and biofuels. Most varieties are drought and heat tolerant, and are especially important in arid regions, where the grain is one of the staple foods for poor and rural people. It is an important food and fodder crop grown in India, and among cereals, it is the fourth most important crop after rice, wheat and maize (Dehinval et al., 2016).

Sorghum grain is used as staple food by millions of people and is grown for grain in southern and central states of India, whereas in northern states of the country (Punjab, Haryana, Uttar Pradesh, Rajasthan, etc.) it is mainly grown as fodder during summer and kharif seasons as a single as well as multicut crop. Among forage crops, forage sorghum could be a strategic option because of the crop’s xerophilic characteristics, adaptation potential, quick growing habit, good ratoon ability, palatability, digestibility and wide range of potential uses as green fodder, dry roughage, hay and silage (Kumar and Chaplot, 2015).

Among crop management practices seeding densities or plant population greatly affect crop growth and then finally grain 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). To obtain high quality preserved forage (silage or hay), harvest sugargraze at knee height stage. For silage, let plants wilt prior to ensiling and lower moisture content will reduce effluent losses from silage. In the India, two to three subsequent harvests are possible. To stimulate recovery growth, fertilize with N immediately following the initial harvest (Smith et al., 2005).

Materials and Methods

Field experiment was conducted during two consecutive years from 2014 and 2015 at Agricultural Research Station, Kota. T1: Sugargraze (seed rate 3.5 kg/ha), T2: Sugargraze (seed rate 5.5 kg/ha), T3: Sugargraze (seed rate 7.5 kg/ha), T4: Sugargraze (seed rate 9.5 kg/ha), T5: Sugargraze (seed rate 11.5 kg/ha) and T6: Local chari (seed rate 10.0 kg/ha). The experimental field was well prepared by two ploughing followed by harrowing and cultivator and one planking for uniform leveling, etc were performed for sowing of sorghum crop. The experiment was laid-out in RBD with four replications and six treatments. The recommended dose of nitrogen, phosphorus and potash i.e.125 kg N/ha, 60 kg P₂O₅/ha and 60 kg K₂O/ha was given in the form of urea, di-ammonium phosphate (DAP) and muriate of potash (MOP). Full dose of DAP and MOP and half N were drilled just before sowing and remaining half-N was applied in two split doses as per recommendation.

The bulk density, pH and cation exchange capacity of these soils varies between 1.30-1.60 Mg/m³, 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 P₂O₅ (24.2±1.0 kg/ha) and medium to high in available K₂O (290±8 kg/ha).

Results and Discussion

Plant population

The plant population and growth parameters of sugargraze were significantly influenced by sowing of different seed rate (Table 1). Pooled data of two years showed that the significantly higher plant population (491886/ha) of sugargraze was recorded with the sowing of 11.5 kg seed/ha which was significantly superior over rest of the treatments.

1st cutting

Two years pooled data indicated that (Table 1) the maximum plant height (154cm), leaf weight/plant (93.75g) and stem weight/plant (280.65 g) were recorded with the sowing of sugargraze by 3.5 kg seed/ha over local chari plant height (132cm), leaf weight/plant (70.6g) and stem weight/plant (214.15 g). However, it was found at par with sowing of sugargraze 5.5 and 7.5 kg seed/ha. Pooled data of two years shows that the fodder yield was significantly influenced by sowing of different seed rate of sugar graze (Table 1). Sowing of sugargraze with 9.5 kg seed/ha were observed maximum green fodder yield (568q/ha), dry fodder yield (153q/ha) and dry matter (26.86%) but it was found at par with the sowing of sugargraze 7.5 kg seed/ha over local chari sowing with 10.0 kg seed/ha green fodder yield (413q/ha), dry fodder yield (109q/ha) and dry matter (25.80%) table 3. These results are in close proximity with those of Dehinwal et al., (2016), Smith et al., (2005) and Jan et al., (2000).
Table 1: Effect of different seed rate on plant population, growth and fodder yield of sugargraze (1st cutting)

| Treatments                      | Plant population (thousand/ha) | Plant height (cm) | Weight of leaves/ plant (g) | Weight of stem/plant (g) | Green fodder yield (q/ha) | Dry fodder yield (q/ha) |
|--------------------------------|--------------------------------|------------------|----------------------------|--------------------------|--------------------------|-------------------------|
|                                | 2014  | 2015  | Pooled | 2014 | 2015  | Pooled | 2014  | 2015  | Pooled | 2014  | 2015  | Pooled | 2014  | 2015  | Pooled | 2014  | 2015  | Pooled |
| T1: Sugargraze (seed rate 3.5 kg/ha) | 156667 | 158400 | 157534 | 153.2 | 153.7 | 153.50 | 93.7 | 93.8 | 93.75 | 280.0 | 281.3 | 280.65 | 386 | 388 | 387 | 107 | 109 | 108 |
| T2: Sugargraze (seed rate 5.5 kg/ha) | 245313 | 247375 | 246344 | 152.2 | 152.5 | 152.38 | 92.7 | 92.8 | 92.75 | 279.0 | 280.0 | 279.50 | 424 | 427 | 426 | 113 | 115 | 114 |
| T3: Sugargraze (seed rate 7.5 kg/ha) | 328750 | 330750 | 329750 | 150.7 | 151.2 | 151.00 | 92.4 | 92.5 | 92.45 | 277.8 | 279.3 | 278.55 | 558 | 562 | 560 | 150 | 151 | 152 |
| T4: Sugargraze (seed rate 9.5 kg/ha) | 408854 | 410900 | 409877 | 141.2 | 143.2 | 142.25 | 91.3 | 91.4 | 91.35 | 275.3 | 276.0 | 275.65 | 566 | 569 | 568 | 152 | 153 | 154 |
| T5: Sugargraze (seed rate 11.5 kg/ha) | 490729 | 493042 | 491886 | 135.5 | 136.5 | 136.03 | 73.5 | 73.7 | 73.6 | 252.5 | 253.8 | 253.15 | 516 | 519 | 518 | 135 | 137 | 138 |
| T6: Local variety (seed rate 10.0 kg/ha) | 417188 | 419025 | 418107 | 131.2 | 132.7 | 131.99 | 70.6 | 70.6 | 70.6 | 213.4 | 214.9 | 214.15 | 411 | 414 | 413 | 106 | 111 | 113 |
|                                | SEm ± | 1102  | 1088  | 1007  | 1.0  | 1.2  | 1.0   | 0.74 | 0.73 | 0.67 | 1.23 | 1.31 | 1.16   | 3.88 | 4.03 | 3.63 | 1.11 | 1.09 | 1.12 |
| CD at 5 %                       | 3318  | 3276  | 2909  | 3.2  | 3.4  | 2.9   | 2.22 | 2.19 | 1.93 | 3.70 | 3.93 | 3.35   | 11.70 | 12.14 | 10.48 | 3.34 | 3.29 | 2.97 |

Table 2: Effect of different seed rate on plant growth and fodder yield of sugargraze (2nd cutting)

| Treatments                      | Plant height (cm) | Weight of leaves/ plant (g) | Weight of stem/ plant (g) | Green fodder yield (q/ha) | Dry fodder yield (q/ha) |
|--------------------------------|------------------|----------------------------|--------------------------|--------------------------|-------------------------|
|                                | 2014  | 2015  | Pooled | 2014 | 2015  | Pooled | 2014  | 2015  | Pooled | 2014  | 2015  | Pooled | 2014  | 2015  | Pooled | 2014  | 2015  | Pooled |
| T1: Sugargraze (seed rate 3.5 kg/ha) | 133  | 134  | 134 | 66.08 | 66.30 | 66.19 | 159.8 | 161.3 | 160.55 | 247 | 250 | 249 | 62 | 64 | 63 |
| T2: Sugargraze (seed rate 5.5 kg/ha) | 132  | 133  | 133 | 65.75 | 66.08 | 65.92 | 157.3 | 158.5 | 157.9 | 263 | 266 | 265 | 68 | 69 | 69 |
| T3: Sugargraze (seed rate 7.5 kg/ha) | 131  | 132  | 132 | 64.75 | 65.05 | 64.90 | 156.0 | 157.3 | 156.65 | 334 | 337 | 336 | 90 | 91 | 91 |
| T4: Sugargraze (seed rate 9.5 kg/ha) | 125  | 126  | 126 | 62.00 | 62.23 | 62.12 | 155.6 | 157.1 | 156.35 | 338 | 340 | 339 | 91 | 93 | 92 |
| T5: Sugargraze (seed rate 11.5 kg/ha) | 120  | 121  | 121 | 55.50 | 55.68 | 55.59 | 135.3 | 136.8 | 136.05 | 265 | 268 | 267 | 67 | 68 | 68 |
| T6: Local variety (seed rate 10.0 kg/ha) | 117  | 118  | 118 | 51.75 | 52.02 | 51.89 | 118.3 | 120.3 | 119.3 | 253 | 256 | 255 | 57 | 60 | 59 |
|                                | SEm ± | 0.67  | 0.84  | 0.69  | 1.01 | 0.98 | 0.91 | 1.28 | 1.65 | 1.34 | 3.00 | 2.87 | 2.70 | 0.58 | 0.71 | 0.59 |
| CD at 5 %                       | 2.02  | 2.52  | 2.00  | 3.05 | 2.96 | 2.64 | 3.86 | 4.98 | 3.89 | 9.05 | 8.66 | 7.79 | 1.74 | 2.13 | 1.71 |
**Table 3** Effect of different seed rate on dry matter (%) and total green and dry fodder yield of sugargraze (1st cutting and 2nd cutting)

| Treatments                     | Dry matter (%) | Green fodder yield (q/ha) | Dry fodder yield (q/ha) |
|--------------------------------|----------------|---------------------------|-------------------------|
|                                | 1st cutting    | 2nd cutting               | Total                   |
|                                | 2014 2015 Pooled | 2014 2015 Pooled | 1st cutting 2nd cutting Total | 1st cutting 2nd cutting Total |
| T1: Sugargraze (seed rate 3.5 kg/ha) | 27.72 27.73 27.73 | 25.10 25.12 25.11 | 387 249 636 | 108 63 171 |
| T2: Sugargraze (seed rate 5.5 kg/ha) | 26.65 26.67 26.66 | 25.85 25.86 25.86 | 426 265 691 | 114 69 183 |
| T3: Sugargraze (seed rate 7.5 kg/ha) | 26.88 26.90 26.89 | 26.94 26.96 26.95 | 560 336 896 | 151 91 242 |
| T4: Sugargraze (seed rate 9.5 kg/ha) | 26.85 26.86 26.86 | 26.92 26.94 26.93 | 568 339 907 | 153 92 245 |
| T5: Sugargraze (seed rate 11.5 kg/ha) | 26.16 26.18 26.17 | 25.28 25.29 25.29 | 518 267 785 | 136 68 204 |
| T6: Local variety (seed rate 10.0 kg/ha) | 25.79 25.81 25.80 | 22.52 22.57 22.55 | 413 255 668 | 109 59 168 |
| SEm ±                          | 0.14 0.14 0.12 | 0.20 0.20 0.18 | 3.63 2.70 - | 1.01 0.59 - |
| CD at 5 %                      | 0.42 0.42 0.37 | 0.59 0.60 0.53 | 10.48 7.79 - | 2.92 1.71 - |

![General View of Experimental plot](image-url)
II\textsuperscript{nd} cutting

During II\textsuperscript{nd} cutting plant growth was significantly influenced (Table 2) by sowing of different seed rate of sugargraze. The maximum plant height (134 cm), leaf weight/plant (66.19 g) and stem weight/plant (160.55 g) of sugargraze were recorded with the sowing of 3.5 kg seed/ha of sugargraze over local chari plant height (118 cm), leaf weight/plant (51.89 g) and stem weight/plant (119.3 g) sowing with 10 kg seed/ha. However, it was found at par with sowing of sugargraze 5.5 and 7.5 kg seed/ha, respectively. Fodder yield of sugargraze was significantly influenced by sowing with different seed rates. The maximum green fodder yield (339 q/ha), dry fodder yield (92 q/ha) (Table 2) and dry matter (26.93%) were observed under sowing of sugargraze 9.5 kg seed/ha but it was found at par with the sowing of sugargraze 7.5 kg seed/ha green fodder yield (336 q/ha), dry fodder yield (91 q/ha) and dry matter (26.95%) over rest of treatments (Table 3). These results are in close proximity with those of Satpal \textit{et al.}, 2016; Kumar and Chaplot.

In conclusion, significantly higher green fodder yield (907 q/ha) and dry fodder yield (245 q/ha) were observed with sowing of sugargraze by 9.5 kg seed/ha over local chari sowing by 10.0 kg seed/ha green fodder yield (668 q/ha) and dry fodder yield (168 q/ha). However, it was found at par with sowing of sugargraze by 7.5 kg seed/ha green fodder yield (896 q/ha) and dry fodder yield (242 q/ha).

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