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# Effect of fertility levels and varieties on growth and yield of multi-cut forage sorghum (*Sorghum bicolor* (L.) Moench)

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## Abstract
A field experiment entitled "Effect of Fertility Levels and Varieties on Growth and Yield of Multi-Cut Forage Sorghum {*Sorghum bicolor* (L.) Moench}" was conducted during *kharif*, 2023 at Agronomy Instructional Farm, RCA, Udaipur (Rajasthan). The experiment consisted of four main plots of fertility levels (Control, 50% RDF, 100% RDF and 150% RDF) and three subplots of sorghum varieties (SPH 1988, CSH 43 MF and CSH 24 MF) in split plot design within three replications. The results revealed that maximum growth and yield of forage sorghum was recorded by applying 150% RDF at each fodder cut. Among tested varieties, CSH 24 MF recorded significantly higher plant height, number of leaves, number of tillers hill$^{-1}$, fresh plant weight and green and dry fodder at each fodder cut.

**Keywords:** Forage sorghum, plant height, number of tillers, yield

## Introduction
Sorghum {*Sorghum bicolor* (L.) Moench} is also known as Jowar originated in Africa and has spread throughout the world. It is one of the staple crops for millions of semi-arid residents and is also known as 'The King of Millets'. Almost 60-70 per cent of the total demand for fodder in *kharif* is met from sorghum. Some of these species have grown as cereals for human consumption and others as animal pastures. When forage sorghum is harvested at 50% flowering stages, it contains 9-10 % crude protein, 32% cellulose and 21-23 % hemicellulose, 37-42 % acid detergent fibre and 60-65 % neutral detergent fibre (Kumar *et al.*, 2012) [2]. In addition to energy, green fodder also provides vitamins and minerals that are helpful in digestion (Surve *et al.*, 2012) [8]. Sorghum stem contains many kinds of sugars, including fructose, sucrose and glucose, with the green and juicy cane alone contributing to 70-80 % of the total biomass.

Sorghum crop for fodder purpose should be used after 50% flowering because sorghum leaves at the knee stage possess a high amount of HCN, which is poisonous to the animals. Also, the HCN potential is higher shortly after germination (Busk and Moller, 2002) [1]. Sorghum is very important crop for both human beings as well as for animals and its production was 58.22 million metric tonnes in 2023 across the world. India ranks sixth and contributes 8 per cent to the total sorghum production globally *i.e.*, 4.40 million metric tonnes. Maharashtra is the major producer, contributing 37 per cent of the total production of sorghum, followed by Karnataka 22 per cent, Tamil Nadu 10 per cent and Rajasthan 8 per cent (USDA, 2023) [10].

A continuous supply of well-balanced nutritive ration in the form of forage is essential to the milch animals for enhancing milk productivity (Meena *et al.*, 2012) [4]. Sorghum is a significant crop that is produced in large quantities of fodder throughout the year. It grows quickly, adapts to a wide range of environmental circumstances and gives animals highly nutrient-rich feed. Sorghum is a highly nutrient-consumptive crop and its fodder production is directly related to fertilizer dose. Higher sorghum production is restricted by two main factors *i.e.*, adequate fertilization and suitable forage sorghum varieties. To achieve self-sufficiency in forage sorghum production, proper management of nutrients plays an important role.

The existing varieties were single-cut types and were not conducive to providing fodder throughout the year. In response to this limitation, multi-cut varieties were developed to ensure a continuous and prolonged supply of green fodder. These multi-cut varieties have higher nutritive value than single cut under the same set of management being an exhaustive crop, the yield and quality of sorghum fodder suffer heavily if the proper amount of fertilizer is not applied. Therefore, these new multi-cut varieties were grown under different fertility conditions to get information on their forage production potential and nutritive value under different fertility levels.

**Material and Methods**

An experiment was conducted during *Kharif* 2023 at RCA, MPUAT, Udaipur (Rajasthan). The soil of the experimental field was clay loam in texture, slightly alkaline (pH 7.7), organic carbon was high (0.68%), low in available nitrogen (289.43), available phosphorus was medium (24.67 kg $ha^{-1}$) and available potassium was high (321.40 kg $ha^{-1}$). The experiment was laid out in split plot design, main plots contain four different fertility levels (Control, 50% RDF, 100% RDF, 150% RDF) and sub-plots contain three varieties (SPH 1988, CSH 43 MF and CSH 34 MF) and replicated thrice. Plot size of the experimental area was 4.5m x 5.10m and crop geometry was 30cm x 05cm. N, P and K was supplied through commercial fertilizers *viz*., DAP, urea and murate of potash. Initially, the entire $P_2O_5$, $K_2O$ with 1/4 N was applied during sowing as a basal dose and the remaining N was supplied as top dressing at 30 DAS and after the first and second fodder cut. The height of five randomly selected plants was measured from the ground to the top of the main shoot during each fodder cut and the average plant height was measured and presented in cm. The number of tillers was counted from five randomly selected plants from each plot after each cut and after that average was taken. The number of leaves of five casually chosen plants was counted during each fodder cut for every treatment. Subsequently, the average leaf count of $plant^{-1}$ was calculated and presented as the number of leaves $plant^{-1}$. For fresh plant weight, total leaves and stem fresh weight of five randomly tagged plant samples were taken at each fodder cut and expressed in g $plant^{-1}$. For the green fodder yield calculation, the weight of green fodder plot-1 was recorded and expressed in kg $ha^{-1}$. For analysis of dry fodder yield, sample bundles of green fodder were collected at each cut, weighed and then placed in the field for sun drying. Once dried, the bundles were weighed again and the dry fodder yield per unit area was calculated and expressed in kg $ha^{-1}$.

**Results and Discussion**

**Growth Parameters**

**Fertility levels:** An examination of data from Table 1 and Table 2 shows that among different fertility levels, the maximum plant height (307.03, 228.14 and 154.89 cm) was obtained under the application of 150% RDF at the first, second and third cut, respectively. This finding was statistically at par with 100% RDF but superior over 50 % RDF and control at each fodder cut. Data further indicate that 150% RDF level statistically improves plant height compared to control with the tune of 64.16 at first cut, 100.89 at second cut and 98.58 per cent at third cut, respectively. The number of tillers $hill^{-1}$ was significantly influenced by different fertility levels at each fodder cut and the application of 150% RDF produced the maximum number of tillers $hill^{-1}$ (4.18, 3.07 and 2.32) which was statistically at par with 50% and 100% RDF at the third cut but significantly superior over remaining fertility levels. The maximum leaf number $plant^{-1}$ was significantly influenced by different fertility levels at each fodder cut, among different fertility levels, the application of 150% RDF gave the maximum leaf number $plant^{-1}$ (9.30, 8.39 and 7.99) at each cut, respectively but it was statistically at par with 100 % RDF in all three cuttings and 50% RDF at second and third cut but higher over rest of the treatments. Fresh plant weight was significantly influenced by different fertility levels at each fodder cut and application of 150% RDF was recorded significantly higher fresh plant weight (362.33, 244.96 and 184.67 g $plant^{-1}$) at each cut, respectively, which was statistically at par with 100% RDF at the second cut. The application of 150 % RDF was statistically higher over rest of the fertility levels in the case of 1st and 3rd cut. The increase in fresh plant weight with 150% RDF was 110.13, 18.24 and 11.64 per cent at the first cut, 107.59, 5.57, 8.49 and 4.54 per cent at second cut, 113.04, 54.18 and 24.68 per cent at third cut over control, 50% and 100% RDF, respectively.

**Varieties:** A closely assessment of data (Table 1, 2) indicates, among the different varieties, CSH 24 MF show the maximum plant height (282.78, 204.73 and 141.83 cm), respectively which was statistically higher over the remaining sorghum varieties at first, second and third fodder cut. Forage sorghum variety, CSH 24 MF showed significantly higher number of tillers $hill^{-1}$ (3.60, 2.79 and 2.31, respectively) at each fodder cut. This result was statistically at par with CSH 43 MF at the first and third cut but higher over SPH 1988 at the second cut. however, it was statistically higher than all tested sorghum varieties. CSH 24 MF produced significantly maximum leaf number $plant^{-1}$ (8.92, 8.24 and 8.02) at each fodder cut, respectively and it was statistically at par with CSH 43 MF at the first and second cut but higher over SPH 1988 and CSH 43 MF at third fodder cut. Among the experimented sorghum varieties, CSH 24 MF recorded the highest fresh plant weight (324.67, 218.30 and 147.17 g $plant^{-1}$, respectively) at each cut and it was higher over SPH 1988 and CSH 43 MF varieties at each fodder cut. The increase in fresh plant weight in CSH 24 MF was 22.14 and 14.39 per cent at the first cut, 12.86 and 6.19 per cent at the second cut and 18.76 and 10.38 per cent at the third cut over SPH 1988 and CSH 43 MF, respectively.

Entire development in forage sorghum may be due to the increased rate of fertilizers, responsible for changing the plant and soil environment which makes it favourable for the growth and development of both biochemical and morphological components. Expansion in these components might be accountable for the higher root growth of plants and its explosion which helps in plant nutrient uptake from the soil. Similar research findings were found with Tandon and Narayan (1990) [9], the changed behaviour of these varieties concerning growth parameters could be described completely by the variations in their genetic inheritance. (Shivadhar *et al*., 2005) [7].

**Fodder yield**

**Fertility levels:** An analysis of data from Table 3 reveals that green and dry fodder yield was significantly influenced by different fertility levels. The maximum green fodder yield (63994, 36971 and 18274 kg $ha^{-1}$) was obtained from the first, second and third cut, respectively under the application of 150% RDF. This result was significantly higher over rest of the fertility levels. The increase in green fodder yield by application of 150% RDF were 54.25, 21.74 and 16.13 per cent at the first cut, 60.76, 26.26 and 16.22 per cent at the second cut and 123.28, 87.67 and 26.94 per cent at the third cut over control, 50% and 100% RDF, respectively. The maximum dry fodder yield (16774, 8148 and 4535 kg $ha^{-1}$) was recorded by application of 150% RDF, at each cut, respectively. The increase in dry fodder yield with 150% RDF was 79.01, 20.90 and 11.81

per cent at the first cut, 74.16, 17.58 and 15.62 per cent at the second cut and 73.33, 19.23 and 15.12 per cent at the third cut over control, 50% RDF and 100% RDF, respectively. The results of the present investigation are in close agreement with the findings of Kumar and Chaplot (2015) [3], Satpal *et al*. (2016) [5].

**Varieties:** A study of data (Table 3) shows that green and dry fodder yield was significantly influenced by different varieties. The maximum green fodder yield was recorded by CSH 24 MF (59584, 34025 and 14288 kg $ha^{-1}$) at the first, second and third fodder cut, respectively. The sorghum variety CSH 24 MF was statistically higher over SPH 1988 and CSH 43 MF at each fodder cut. The increase in green fodder yield by CSH 24 MF were by 22.52 and 15.36 per cent at the first cut, 29.41 and 11.63 per cent at the second cut and 20.54 and 21.08 per cent at the third cut over SPH 1988 and CSH 43 MF, respectively. The maximum dry fodder yield recorded by CSH 24 MF (14947, 7325 and 4056 kg $ha^{-1}$) from the first, second and third fodder cut, respectively and it was statistically higher over SPH 1988 and CSH 43 MF at each fodder cut. The increase in dry fodder yield in CSH 24 MF was 18.89 and 8.82 per cent at the first cut, 20.99 and 8.89 per cent at the second cut and 19.56 and 8.90 per cent at the third cut over SPH 1988 and CSH 43 MF, respectively. Differences in green and dry fodder yield of the fodder sorghum varieties might be due to high vigour and genetic differences in growth characteristics. Similar research results were also done by Satpal *et al*. (2018) [6] and Yadav *et al*. (2019) [11].

**Table 1:** Effect of fertility levels and sorghum varieties on plant height and tiller number $hill^{-1}$ of sorghum

| Treatments | Plant height (cm) | | | Number of Tillers $hill^{-1}$ | | |
|---|---|---|---|---|---|---|
| | 1st Cut | 2nd Cut | 3rd Cut | 1st Cut | 2nd Cut | 3rd Cut |
| **Fertility levels** | | | | | | |
| Control | 187.03 | 113.56 | 78.00 | 2.72 | 1.92 | 1.64 |
| 50% RDF | 246.11 | 184.89 | 140.78 | 3.32 | 2.47 | 2.18 |
| 100% RDF | 274.44 | 221.64 | 148.78 | 3.51 | 2.78 | 2.26 |
| 150% RDF | 307.03 | 228.14 | 154.89 | 4.18 | 3.07 | 2.32 |
| SEm± | 10.78 | 5.82 | 3.83 | 0.04 | 0.08 | 0.12 |
| C.D. (P=0.05) | 37.29 | 20.14 | 13.25 | 0.15 | 0.26 | 0.43 |
| **Varieties** | | | | | | |
| SPH 1988 | 230.00 | 174.10 | 120.50 | 3.19 | 2.34 | 1.94 |
| CSH 43 MF | 248.19 | 182.33 | 129.50 | 3.50 | 2.55 | 2.05 |
| CSH 24 MF | 282.78 | 204.73 | 141.83 | 3.60 | 2.79 | 2.31 |
| SEm± | 6.73 | 4.75 | 2.40 | 0.05 | 0.07 | 0.09 |
| C.D. (P=0.05) | 20.19 | 14.23 | 7.20 | 0.14 | 0.20 | 0.27 |

**Table 2:** Effect of fertility levels and sorghum varieties on Leaf number $plant^{-1}$ and Fresh plant weight (g $plant^{-1}$) of sorghum

| Treatments | Leaf number $plant^{-1}$ | | | Fresh plant weight (g $plant^{-1}$) | | |
|---|---|---|---|---|---|---|
| | 1st Cut | 2nd Cut | 3rd Cut | 1st Cut | 2nd Cut | 3rd Cut |
| **Fertility levels** | | | | | | |
| Control | 7.93 | 7.30 | 6.67 | 172.44 | 118.00 | 86.67 |
| 50% RDF | 8.31 | 7.61 | 7.67 | 306.44 | 225.80 | 119.78 |
| 100% RDF | 8.93 | 8.28 | 7.54 | 324.56 | 234.31 | 148.11 |
| 150% RDF | 9.30 | 8.39 | 7.99 | 362.33 | 244.96 | 184.67 |
| SEm± | 0.20 | 0.26 | 0.21 | 6.52 | 3.13 | 2.44 |
| C.D. (P=0.05) | 0.69 | 0.92 | 0.74 | 22.56 | 10.83 | 8.43 |
| **Varieties** | | | | | | |
| SPH 1988 | 8.35 | 7.63 | 7.15 | 265.83 | 193.43 | 123.92 |
| CSH 43 MF | 8.59 | 7.81 | 7.23 | 283.83 | 205.57 | 133.33 |
| CSH 24 MF | 8.92 | 8.24 | 8.02 | 324.67 | 218.30 | 147.17 |
| SEm± | 0.12 | 0.16 | 0.18 | 4.59 | 2.20 | 1.69 |
| C.D. (P=0.05) | 0.36 | 0.48 | 0.55 | 13.75 | 6.61 | 5.08 |

**Table 3:** Effect of fertility levels and sorghum varieties on green and dry fodder yield of Sorghum (kg $ha^{-1}$)

| Treatments | Green fodder yield (kg $ha^{-1}$) | | | Dry fodder yield (kg $ha^{-1}$) | | |
|---|---|---|---|---|---|---|
| | 1st Cut | 2nd Cut | 3rd Cut | 1st Cut | 2nd Cut | 3rd Cut |
| **Fertility levels** | | | | | | |
| Control | 41487 | 23001 | 8184 | 9367 | 4680 | 2617 |
| 50% RDF | 52564 | 29281 | 9737 | 13875 | 6929 | 3804 |
| 100% RDF | 55104 | 31810 | 14393 | 15002 | 7048 | 3939 |
| 150% RDF | 63994 | 36971 | 18274 | 16774 | 8148 | 4535 |
| SEm± | 1660 | 1079 | 568 | 339.63 | 203.49 | 118.41 |
| C.D. (P=0.05) | 5743 | 3735 | 1967 | 1175.26 | 704.16 | 409.74 |
| **Varieties** | | | | | | |
| SPH 1988 | 48630 | 26292 | 11853 | 12583 | 6053 | 3392 |
| CSH 43 MF | 51647 | 30480 | 11800 | 13734 | 6726 | 3724 |
| CSH 24 MF | 59584 | 34025 | 14288 | 14947 | 7324 | 4055 |
| SEm± | 1093 | 947 | 302 | 199.33 | 107.94 | 59.59 |
| C.D. (P=0.05) | 3276 | 2838 | 907 | 597.59 | 323.61 | 178.64 |

## Conclusion
The present investigation revealed that the application of higher fertility levels *viz*., 150% RDF gave maximum plant growth and yield at each fodder cut and among tested varieties CSH 24 MF gave the best results on growth parameters and yield.

## References

1. Busk PK, Moller BL. Dhurrin synthesis in sorghum is regulated at the transcriptional level and induced by nitrogen fertilization in older plants. Plant Physiology. 2002;129(3):1222-1231.
2. Kumar S, Agrawal RK, Dixit AK, Rai AK, Rai SK. Forage crops and their management. Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh, India, c2012, p. 3-6.
3. Kumar D, Chaplot PC. Performance of multi-cut forage sorghum genotypes to fertility levels. Forage Research 2015;41(3):199-201.
4. Meena AK, Singh P, Kanwar P. Effect of nitrogen levels on yield and quality of sorghum (*Sorghum bicolor* L.) genotypes. Forage Research. 2012;37:238-240.
5. Satpal Duhan BS, Arya S, Kumari P, Devi S. Performance of single cut forage sorghum genotypes to different fertility levels. Forage Research. 2016;42:184-188.
6. Satpal Tokas J, Kumar A, Kumar SR. Potential productivity and radiation use efficiency of multi-cut forage sorghum (*Sorghum bicolor*) genotypes. Journal of Agrometeorology. 2018;20:364-367.
7. Shivadhar Gupta SD, Tripathi SN, Rai SK. Production potential of fodder sorghum (*Sorghum bicolor*) varieties under different nitrogen levels and sowing dates. Indian Journal of Agricultural Sciences. 2005;75:572-577.
8. Surve VH, Arvadia MK. Performance of fodder sorghum (*Sorghum bicolor* L.), maize (*Zea mays* L.) and cowpea (*Vigna unguiculata* (L.) Walp.) under sole and intercropping systems. International Journal of Agriculture: Research and Review. 2012;2(1):28-31.
9. Tandon HLS. Pratap Narayan. Fertilizer in Indian agriculture: past, present and future (1950-2000). FDCO, C-110, Greater Kailash, New Delhi; c1990.
10. USDA, United States Department of Agriculture. Sorghum Explorer, 2023, https://ipad.fas.usda.gov/cropexplorer/cropview/commodityView.aspx?cropid=0459200&sel_year=2023&rankby=Production, retrieved on dated 20-06-2024.
11. Yadav K, Verma A, Yadav MK, Choudhary M, Choudhary KM. Effect of fertilizer levels on fodder productivity and quality of multi-cut sorghum genotypes. International Journal of Bio-resource and Stress Management. 2019;10(2):119-123.