*Forage Res.*, **47** (2) : pp. 209-212 (2021) **http://forageresearch.in**

# EFFECT OF INTEGRATED NITROGEN AND CUTTING MANAGEMENT ON GROWTH, YIELD AND QUALITY OF SUMMER FORAGE SORGHUM

**A. A. GIRI*, S. H. PATHAN AND S. V. DAMAME**

Department of Agronomy
Mahatma Phule KrishiVidyapeeth, Rahuri-413 722
District Ahmednagar (Maharashtra), India
**(e-mail : giriashwini936@gmail.com)*

**(Received : 3 September 2021; Accepted : 28 September 2021)**

**SUMMARY**

A field experiment was carried out at Post Graduate Instructional Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) during summer, 2018-19.The experiment was laid out in Factorial Randomized Block Design with eight treatments and four replications. The application of 125% RDN (75% RDN- through urea + 25% RDN –through Vermicompost) and second cutting management treatment (1st cut at 80 DAS and 2nd cut 60 days after 1st cut) recorded significantly maximum growth and yield attributes *viz*., plant height, number of leaves/plant, leaf : stem ratio, green forage yield (703.21,663.67 q/ha), dry matter yield(140,130.83 q/ha), crude protein yield (11.61,10.32 q/ha) and crude fiber yield (41.51, 39.24 q/ha), respectively. The extent of expression of a quality parameter IVDMD (62.13%) was recorded significantly highest with application of 125% RDN (75% RDN- through urea + 25% RDN -through Vermicompost) and first cutting management cut treatment (1st cut at 80 DAS and 2nd cut at 50 days after 1st cut) was recorded significantly highest IVDMD (61.84%). On the basis of economic studies application of 125% RDN (75% RDN- through urea + 25% RDN -through Vermicompost) INM fertilizer level with second cutting management treatment (1st cut at 80 DAS and 2nd cut at 60 days after 1st cut) was found most remunerative to obtain significantly the highest net monetary returns (Rs. 77691/ha and Rs. 72794/ha) and B : C ratio (2.85 and 2.81), respectively.

**Key words :** Sorghum, yield, quality, INM, cutting management

Sorghum is one of the gifted grass genera of the tropics. Among the *Kharif* forage crops, multicut hybrid sorghum has wide adaptability in different agro-climates besides drought withstanding ability because of its xerophytic characteristics, it also has a great potential of adaptation to adverse climatic conditions. Hence, it is considered as promising crop to overcome the fodder shortages. As feeds and fodders are the most important components of animal output. By adequate supply of more nutritious feed and fodder by stall feeding, more productive milch herds can be maintained which would accelerate the growth of milk production. Sorghum is a palatable and nutritious fodder crop for animals and there is enormous demand for green and dry fodder particularly during lean winter and summer season in all regions of the world. Although, Maharashtra ranks first in sorghum area (13.84 m ha area in *Kharif* and 30.17 m ha area in rabi season), the state ranks third in productivity of grain, forage and other (Anonymous, 2020). Being an exhaustive crop, quality of sorghum fodder suffers heavily if proper amount of fertilizers is not applied.

Multicut sorghum is capable of producing high-quality forage in mid to late summer when cool-season perennials have low production. For increase the productivity of the crop, balanced use of nitrogenous fertilizer and cutting management is an important practice has played a key role in securing higher production. The combination of organic and inorganic nitrogen might have increased photosynthetic rate and net assimilation rate with special significance in increasing green biomass yield and its quality in fodder crops. Sorghum variety *Phule Godhan* responds positively to application of nitrogenous fertilizers.

Considering this view, the experiment was conducted to study the effect of integrated nitrogen and cutting management on growth, yield and quality of summer fodder sorghum (cv. *Phule Godhan)*.

## MATERIALS AND METHODS

An experiment was conducted during summer season of 2018-19 at Post Graduate Instructional Farm, Department of Agronomy, Mahatma Phule Krishi Vidyapeeth, Rahuri (Maharashtra). The meteorological data recorded on important weather parameters during March 2019 to August 2019 at Meteorological Observatory is graphically depicted in Fig. 1 showing climatic condition during the period of present investigation.

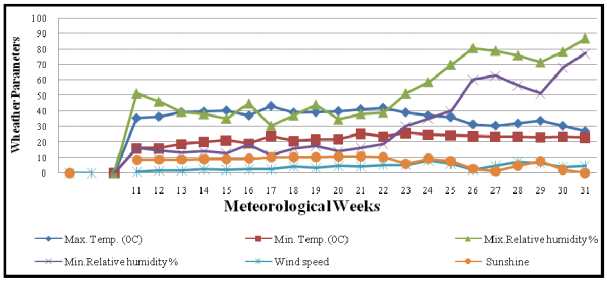


Fig. 1. Meteorological data recorded during the experimental period.

The maximum and minimum temperature was ranged from 27.0$^0$C to 43.3$^0$C and 16.0$^0$C to 26.0$^0$C during crop period, respectively. The relative humidity during morning and evening ranged from 30.57 to 87.00 per cent and 13.00 to 77.42 per cent respectively and total 31.4 mm of rainfall was received in 10 rainy days in the 2019 during the period of experiment. However, the maximum bright sunshine hours recorded was 10.9 hours in 21$^{th}$ MW of 2019. The minimum sunshine hours recorded was 0.2 hours during 31$^{th}$ MW of 2019. The highest wind velocity was recorded 8.3 km hr$^{-1}$ during 24$^{th}$ MW of 2019 and lowest wind velocity was recorded 0.9 km hr$^{-1}$ during 11$^{th}$ MW of 2019.

The soils of experimental field was clay loam in texture, low in available nitrogen (170.56 kg/ha), medium in available phosphorus (28 kg/ha) and very high in available potassium (510 kg/ha). It was moderately alkaline in reaction (pH 8.47). Electrical conductivity of soil was 0.50 dSm$^{-1}$ with 0.31 per cent organic carbon. The experiment carried out with well rotten FYM and Vermicompost rich in nitrogen, phosphorous, potassium and organic carbon (0.54, 0.26, 0.58, 0.62) and (1.52, 0.74, 0.86, 15.5), respectively. The experiment was laid out in factorial randomized block design with four replications. The experiment consists of eight treatment combinations involving four treatments of INM fertilizer levels i.e. $F_{1}$- RDF (100:50:40 kg NPK ha-$^{1}$ + 3 tonnes FYM ha$^{-1}$), $F_{2}$-125% RDN (75% RDN-through Urea + 25% RDN-through FYM), $F_{3}$-125% RDN (75% RDN-through Urea + 25% RDN-through Vermicompost), $F_{4}$-100% RDN (75% RDN-through Urea + 25% RDN through Vermicompost) and two cutting management treatment i.e. first cutting management treatment ($C_{1)}$-1$^{st}$ cut at 80 DAS and 2$^{nd}$ cut at 50 days after 1st cut and second cutting management ($C_{2)}$-1$^{st}$ cut at 80 DAS and 2$^{nd}$ cut at 60 days after 1$^{st}$ cut. The recommended fertilizer dose (100:50:40 kg N, $P_2O_5$, $K_2O$ kg ha$^{-1}$) was applied. The full dose of $P_2O_5$, $K_2O$ and ½ dose of N was applied as basal dose at sowing. The quantity of FYM and Vermicompost was applied before sowing as per the treatment and remaining ½ dose of N was top dressed at 30 DAS. Additional 25 kg N/ha was applied to all the treatments immediately after 1$^{st}$ cut & again 25 kg N/ha was applied to all treatments 30 days after 1$^{st}$ cut.

## RESULTS AND DISCUSSION

### Growth attributing characters

The initial and final plant stand did not exhibit any noticeable difference due to different treatment of INM fertilizer levels and cutting management. The growth characters of sorghum in terms of mean plant height, number of functional leaves and leaf: stem ratio were influenced due to different INM fertilizer levels. Application of 125% RDN (75% RDN- through urea + 25% RDN -through Vermicompost) fertilizer level along with second cutting management treatment ($C_2$)-(1$^{st}$ cut at 80 DAS and 2$^{nd}$ cut at 60 days after 1$^{st}$ cut) recorded maximum growth characters at first as well as second cutting management treatment *viz*., plant height (276.00, 284.2 cm), number of functional leaves plant$^{-1}$ (13.91, 13.14), leaf: stem ratio (0.23, 0.21), respectively. These results are in agreement with the findings of Somashekar *et al*. (2015) and Kumawat *et al*. (2016).

### Yield and quality parameter

The INM fertilizer levels treatment $F_3$-125% RDN (75% RDN- through urea + 25% RDN -through Vermicompost) and $C_2$-second cutting management treatment (1$^{st}$ cut 80 DAS and 2$^{nd}$ cut at 60 days after 1$^{st}$ cut) recorded significantly higher total green fodder yield (703.21, 663.67 q/ha), dry matter yield (140.07, 130.83 q/ha), crude protein yield (11.61, 10.32 q/ha) and crude fiber yield (41.51, 39.24 q/ha), respectively.

TABLE 1
Growth, yield and quality parameters of forage sorghum as affected by INM fertilizer levels and cutting management.

| Treatments | Plant height (cm) | No. of functional leaves/ plant | Leaf : stem ratio | Green forage yield (q/ha) | Dry matter yield (q/ha) | Crude protein yield (q/ha) | Crude fibre yield (q/ha) | IVDMD (%) |
|---|---|---|---|---|---|---|---|---|
| **A) INM-Fertilizer levels (4)** | | | | | | | | |
| $F_1$ -RDF (100:50:40 kg NPK/ha + 3 tonnes FYM/ha) | 261.37 | 13.00 | 0.20 | 592.40 | 116.46 | 9.09 | 34.87 | 61.57 |
| $F_2$-125% RDN (75% RDN-through Urea + 25% RDN-FYM) | 268.75 | 13.13 | 0.21 | 652.40 | 128.91 | 10.21 | 38.24 | 61.74 |
| $F_3$-125% RDN (75% RDN-through Urea + 25% RDN-through Vermicompost) | 276.00 | 13.91 | 0.23 | 703.21 | 140.07 | 11.61 | 41.51 | 62.13 |
| $F_4$-100% RDN (75% RDN-through Urea + 25% RDN through Vermicompost) | 255.01 | 12.78 | 0.18 | 564.21 | 110.35 | 8.55 | 33.34 | 61.51 |
| S.E m± | 1.48 | 0.18 | 0.002 | 1.77 | 0.55 | 0.07 | 0.23 | 0.07 |
| C.D. at 5% | 4.46 | 0.57 | 0.008 | 5.15 | 1.73 | 0.22 | 0.72 | 0.24 |
| **B) Cutting management (2)** | | | | | | | | |
| $C_1$-1stcut at 80 DAS and 2ndcut at 50 days after 1st cut | 276.75 | 12.98 | 0.20 | 592.43 | 117.06 | 9.38 | 34.83 | 61.84 |
| $C_2$-1stcut at 80 DAS and 2ndcut at 60 days after 1st cut | 284.2 | 13.14 | 0.21 | 663.67 | 130.83 | 10.32 | 39.24 | 61.63 |
| S. Em± | 1.21 | 0.13 | 0.001 | 1.25 | 0.40 | 0.05 | 0.11 | 0.05 |
| C.D. at 5% | 3.62 | NS | 0.006 | 3.64 | 1.24 | 0.15 | 0.34 | 0.12 |
| **C) Interaction (FxC)** | | | | | | | | |
| S.E m± | 2.60 | 0.26 | 0.003 | 2.50 | 1.03 | 0.02 | 0.10 | 0.04 |
| C.D. at 5% | NS | NS | NS | 6.73 | 3.10 | 0.07 | 0.32 | 0.11 |
| General mean | 265.28 | 13.20 | 0.20 | 628.05 | 123.95 | 10.11 | 37.03 | 61.74 |

TABLE 2
Nutrient uptake and economics of forage sorghum as affected by different INM fertilizer and cutting management treatments.

| Treatments | Total Nutrient Uptake (kg/ha) | | | Gross monetary returns (Rs./ha) | Cost of cultivation (Rs./ha) | Net monetary returns (Rs./ha) | B : C ratio |
|---|---|---|---|---|---|---|---|
| | N | P | K | | | | |
| **A) INM-Fertilizer levels (4)** | | | | | | | |
| $F_1$ -RDF (100:50:40 kg NPK/ha + 3 tonnes FYM/ha) | 136.13 | 20.74 | 167.57 | 100708 | 37638 | 63070 | 2.67 |
| $F_2$-125% RDN (75% RDN-through Urea + 25% RDN-FYM) | 140.97 | 22.43 | 171.35 | 110908 | 39935 | 70973 | 2.77 |
| $F_3$-125% RDN (75% RDN-through Urea + 25% RDN-through Vermicompost) | 153.50 | 24.06 | 178.69 | 119546 | 41855 | 77691 | 2.85 |
| $F_4$-100% RDN (75% RDN-through Urea + 25% RDN through Vermicompost) | 134.68 | 19.63 | 165.52 | 95958 | 36451 | 59465 | 2.63 |
| S.E m± | 1.15 | 0.54 | 1.12 | 388 | - | 388 | - |
| C.D. at 5% | 3.51 | 1.66 | 3.42 | 1363 | - | 1363 | - |
| **B) Cutting management (2)** | | | | | | | |
| $C_1$-1stcut at 80 DAS and 2ndcut at 50 days after 1st cut | 141.27 | 21.58 | 170.24 | 100713 | 37910 | 62804 | 2.65 |
| $C_2$-1stcut at 80 DAS and 2ndcut at 60 days after 1st cut | 144.82 | 22.49 | 173.47 | 112824 | 40030 | 72794 | 2.81 |
| S.E m± | 0.81 | 0.38 | 0.79 | 245 | - | 245 | - |
| C.D. at 5% | 2.48 | 1.13 | 2.42 | 943 | - | 943 | - |
| **C) Interaction (FxC)** | | | | | | | |
| S.E m± | 0.53 | 0.76 | 1.58 | 311 | - | 311 | - |
| C.D. at 5% | 1.62 | NS | NS | 936 | - | 936 | - |
| General mean | 143.05 | 22.04 | 171.85 | 106769 | 38970 | 67799 | 2.74 |

It also recorded significantly higher IVDMD (62.13%). However, in respect to cutting management treatment ($C_1$)-(1st cut at 80 DAS and 2nd cut at 60 days after 1st cut) recorded higher IVDMD (61.63%). These results are in conformity with Devi *et al*. (2014), Kalra and Sharma (2015) and Damame *et al*. (2017).

**Nutrient uptake study**

The significantly higher total nutrient uptake of nitrogen (153.50, 144.82 kg/ha), phosphorous (24.06, 22.49 kg/ha) and potassium (178.69, 173.47 kg/ha), respectively were recorded by forage sorghum with application of INM fertilizer level of 125% RDN (75% RDN- through urea+25% RDN -through Vermicompost) along with second cutting management treatment (1stcut at 80 DAS and 2ndcut at 60 days after 1stcut). Similar result was reported by Sutar *et al*. (2020).

## ECONOMICS

The gross monetary returns, net monetary returns and benefit: cost ratio of forage sorghum was significantly influenced by different INM fertilizers and cutting management treatments (Table 2). The highest gross monetary returns (Rs. 119546, 112824/ ha), net monetary returns (Rs. 77691, 72794/ha) and B : C ratio (2.85,2.81) were recorded by application of 125% RDN (75% RDN- through urea + 25% RDN -through Vermicompost) and INM fertilizer level with second cutting management treatments ($C_2$) *i.e.* (1st cut at 80 DAS and 2nd cut at 55 to 60 days after 1st cut). Similar trend was also indicated by Sheoran *et al*. (2016) and Choudary *et al.* (2018).

## CONCLUSION

Based on the results, it can be concluded that application of 125% RDN (75% RDN- through urea + 25% RDN- through Vermicompost) along with cutting management as 1st cut at 80 DAS and 2nd cut at 60 days after 1st cut could be appropriate for achieving the higher yield contributing characters such as green forage, dry matter and crude protein yields as well as for obtaining net monetary returns from the forage sorghum *cv*. *Phule Godhan* during summer season.

## REFERENCES

Anonymous, 2020 : Area, production and productivity of India and Maharashtra. (www.icar.com) Sorghum- ICAR-CCARI.

Choudary, P. K., Singh, R. and Singh, A. C. 2018 : Effect of integrated nitrogen management and spacing on yield, quality and economics of fodder maize (*Zea mays* L.) var. Shiants Makka-2. *International Journal of Current Microbiology in Applied Science,* 7(10): 1269-1273.

Damame, S.V., S.B. Gore, B.T. Sinare, M.G. Gavit and H.P. Pardeshi, 2017 : Forage quality of Bajra × Napier Hybrid *cv*. Phule Jaywant as affected by growing environments and nitrogen levels. *Indian Journal of Animal Nutrition,* **34** (3): 310-315.

Damame S.V., S.B. Gore, B.T. Sinare, M.G. Gavit and H.P. Pardeshi, 2017 : Forage quality of Bajra × Napier Hybrid *cv*. Phule Jaywant as affected by growing environments and nitrogen levels. *Indian Journal of Animal Nutrition,* **34** (3): 310-315.

Devi, U., K. P. Singh, S. Kumar and M. Sewhag, 2014 : Effect of nitrogen levels, organic manures and *Azotobactor* inoculation on yield and economics of multi-cut oat (*Avena sativa*). *Forage Research*, **40**(1): 36-43.

Kumawat, S. M., A. Mohd, S. S. Shekhawat and S. R. Kantwa, 2016 : Effect of nitrogen and cutting management on growth, yield and quality of fodder pearl millet (*Pennisetum glaucum* L.) cultivars. *Range Management & Agroforestry,* **37**(2): 207-213.

Sheoran, R. S., U.S. Tiwana, N.S. Yadav and U.N. Joshi, 2016 : Evaluation of promising forage pearl millet (*Pennisetum glaucum*) varieties for fodder and seed production with different nitrogen levels under varying environments. *Forage Research,* **33**(4): 206-211.

Somashekar K. S., B. G. Shekara, K. N. Kalyanamurthy and L. Harish, 2014 : Yield, nitrogen uptake, available soil nutrients and economics of multicut fodder sorghum (*Sorghum Sudanese* L.) to different seed rates and nitrogen levels. *Forage Research,* **40**(1): 23-27.

Sutar, S. H., S. H. Pathan and S. V. Damame, 2020 : Response of forage pearl millet to integrated nitrogen and cutting management during summer season. *Bioinfolet.,* **17**(4 A): 539-541.

Kalra, V. P. and P. K. Sharma, 2015 : Quality of fodder maize in relation to farm yard manure and nitrogen levels. *Forage Research,* **41**(1): 63-67.