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Performance of marvel grass varieties under different levels of nitrogen in irrigated condition of the middle Gujarat agroclimatic zone of Gujarat

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ABSTRACT

Main Forage Research Station, ICAR Unit 9, Anand Agricultural University located in the middle agroclimatic zone of Gujarat India, has different Agroclimatic zone with a different agricultural pattern. Most of the farmers are doing agriculture as a first enterprise and dairy as a second one. The demand for fodder is higher in the different zone of Gujarat state. To improve cultural practices and reduced the shortfall of fodder with highly nutritive fodder these studies were carried out to evaluate the effect of the level of nitrogen on different marvel grass varieties in middle Gujarat. Continuous three years of experimentation on marvel grass, results revealed that marvel grass varieties did not show significant effects on growth, yield attributes, and yield as well as quality parameters. A perusal of experiment data revealed that application of 60 kg N/ha (30 kg N/ha at the time of transplanting or immediately after cutting and 30 kg N/ha at 30 DAS/ 30 Days after each cutting) noted higher growth parameters (height and several tillers per meter row length) also reported higher total green fodder yield and quality of marvel grass as well as higher net return and benefit-cost ratio.

Keywords: *Marvel grass, nitrogen, green fodder yield, dry matter, total dry matter yield, crude protein total crude protein yield, Acid detergent fiber and Neutral detergent fiber*

Introduction

Marvel grass (*Dichanthium annulatum (Forssk.) Stapf*) is a highly valuable and important forage grass in India and Africa [1]. It is one of the popular pasture grasses in many areas of India since ancient times. Presently these grasses are most popular among dairy farmers and are also utilized in the open grazing area. It can be used for grazing livestock as green fodder and dry fodder utilized for making hay and silage. Most milking animals are reared on crop-based reside, and the availability of green fodder, dry fodder, and concentration is deficient by 36 %, 40 %, and 44 %, respectively. It, therefore, introduced an improved package of practices for achieving scarcity in fodder production. Due to its high palatability capacity, it is most favourable for ruminants. It grows well in areas of 350 to 2000 mm rainfall of arid regions with good sun light [1). It is widely adaptable in low rainfall areas of Gujarat and Rajasthan as well as heavy rainfall areas of south Gujarat. It tolerates a wide range of soils, , more suitable under black cotton soil, but not suitable under acid soil. Forage grasslands are used to feed livestock.

Forage production can be improved through balance fertilization and management. Essential nutrients like nitrogen, phosphorus, and other micronutrients are important for plant growth and development. Nitrogen plays an important role among all major nutrients in both qualitative and quantitative fodder production. Nitrogen is required for fodder production as it influences cell elongation, inter-nodal expansion, and cell division. It is also important for the early establishment of the crop. It improves growth parameters and dry matter growth to increase fodder yield [2]. Nitrogen turns plants green and promotes early vegetative development. The application of nitrogen is important for forage yield and improved quality parameters of fodder grass.

Because of the above consideration, and less research work in grasses the experiments on the level of nitrogen in different varieties of marvel grass was planning to develop technology for dairy farmers.

Material and Method

Field experiment was carried out at Main Forage Research Station, Anand Agricultural University, Anand to evaluate the effect of nitrogen level on different varieties of marvel grass during *kharif 2018* to *kharif* 2021 in loamy sand soil of Gujarat. Evaluation carried out on two marvel grass varieties i.e GMG 1 (Gujarat Marvel grass 1) and GAMG 2 (Gujarat Anand Marvel grass 2) and three levels of nitrogen (N_1:20 kg N/ha, N_2:40 kg N/ha, and N_3:60 kg N/ha). In total six treatment combinations were evaluated at the experiment location with four replications and a total of twenty-four treatment plots. Different combinations are sown in a 50 × 50 cm i.e 50 cm between two rows as well as between two plant s within 6.0 m row length row-column design with a uniform plot size of 4.0 × 6.0 m at Main Forage Research Station. Replicated row data were analyzed through Randomized block design with the factorial

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concept. The soil of the experiment was low in organic carbon (0.30 %), available phosphorus (37.50 kg/ ha), and available potassium (285 kg/ha) with a soil pH of 7.60. During the experimentation period, a total of 18 cuts were taken. Nitrogen was applied as a basal and topdressing after every cut (half at transplanting/just after cutting and remaining at 30 DAS/30 days after each cut). The marvel grass maintained continuously up to *Kharif* 2021. During the *rabi* and summer seasons, irrigation is done at 15 days and 20 days intervals, respectively for proper growth and development. For the proximate analysis used standard protocol analysis. The experiment was conducted continuously for three years and took 18 cuts during the period. Standard protocol for calculating dry matter yield, crude protein yield, ADF, and NDF was followed.

Results and Discussion

Marvel grass is great popular for fodder grass and it adores by all ruminants' animals. It is mixed with all other grasses, feed, and fodder as a green or dry for animal feeding. The collected data have been discussed in three parts growth, yield, and quality.

Effect of varieties

Data presented in Table 1 indicated the response of different varieties on growth, green fodder yield, and quality of marvel grass. Response of marvel grass varieties on plant height at each cut and number of tillers per meter row length was found to be non-significant. Varieties effect (*Cv.* GMG 1 and GAMG 2) on total green fodder yield was found to be non-significant, Their mean potentialities of these varieties are similar under field conditions by which either grow GMG 1 or GAMG 2 varieties for fodder cultivation. Quality parameter plays a major role in judging the quality of any fodder. Response of marvel grass varieties on fodder quality like dry matter content, crude protein content, dry matter yield, crude protein yield, acid detergent fiber, and neutral detergent fiber were found to be non-significant. According to analyzed data, it said that for all growth, yield as well as quality parameters, grow either GMG 1 or GAMG 2 varieties under irrigated conditions of middle Gujarat.

Effect of nitrogen level

Data revealed a significantly higher plant height (91.06 cm) and number of tillers per meter row length (63.67) at a higher level of nitrogen (N_3: 60 kg N/ha) than the rest of the nitrogen level. Nitrogen is a major element that is essential for the synthesis of amino acids, nucleic acid, some organic acids, it is very useful and necessary for element for plant growth development. The height of the plant increased with an increased dose of nitrogen. It might be fact that nitrogen is an important constituent of chlorophyll, nucleotides, proteins, and enzymes involved in various metabolic process, which has a direct impact on the vegetative and reproductivity phase of plants. The increment increase in plant height with the increase in nitrogen levels indicated that plants used a sufficient amount of nitrogen during active cell division to form building blocks (protein) for cell elongation [3].

Perusal of data noted in Table 1 indicated that the application of nitrogen significantly ffects total green fodder yield, crude protein content total crude protein yield, and total dry matter yield. Increasing levels of nitrogen from 20 to 60 kg N/ha reported significantly higher total green fodder yield (1799 q/ha) of marvel grass. Treatment N_1 (20 kg N/ha) reported significantly the lowest total green fodder yield (1280 kg N/ha).

The increasing total green fodder yield by application of nitrogen might be due to increasing levels of nitrogen providing sufficient nitrogen to crop that requires proper growth and development of plant which stimulates the chlorophyll content so ultimately increase photosynthesis and biomass production will be increased [1, 4].

Response of the level of nitrogen on dry matter content was found to be non-significant. Protein has a vital role in human nutrition Nitrogen application affects the crude protein content in forage. The amount of crude protein can increase with increasing nitrogen application rate. Significantly higher crude protein content (5.78%) was reported in higher levels of nitrogen (N_3: 60 kg N/ha). Increasing crude protein content by application of nitrogen might be due to nitrogen being an active component of the protein molecule and a building block of amino acid results gives good results in crude protein content. Analysis data reported in Table 1 indicated that the response of nitrogen on total dry matter yield and crude protein yield was found significant. Application of 60 kg N/ha (N_3) reported significantly the maximum total dry matter yield (806 q/ha) and total crude protein yield (46.03 q/ha) over both levels of nitrogen i.e N_1 and N_2 the lower levels of nitrogen (N_1), whereas the response of nitrogen on dry matter content was found non-significant. Increasing crude protein yield and dry matter yield mainly due to better translocation within plant systems with higher levels of nitrogen. Increasing fodder yield, dry matter, and crude protein content have a direct relation with quality yield production. Neutral detergent fiber and acid detergent fiber did not show significant effect.

Interaction effect

Data presented in Fig 2 regarding the interaction effect of marvel grass and level of nitrogen on the number of tillers per meter row length. The treatment V_2N_3 i.e.variety GAMG 2 (V_2) with a higher level of nitrogen (N_2: 60 kg N/ha) reported significantly the maximum number of tillers per meter row length (65.57), while a lower number of tillers per meter row length (50.85) was reported in N_1V_1 treatment combination (N_1: 20 kg N/ha and V_1: GMG 1).

Economic

Data presented in (Fig.1) regarding the response of varieties on net return and BCR. Variety V_2 (GAMG 2) reported numerically higher net realization (147318 Rs/ha) with BCR (1.93). A higher rate of application N_3 (60 kg N/ha) reported higher net realization (182790 Rs/ha) with a benefit-cost ratio (2.03).

Conclusion

Forage grass has its importance in the dairy sector. Selection of variety, and rate of application of nitrogen directly responsible for healthy and quality fodder production. For a three-year ongoing experiment on the response of different marvel varieties on level of nitrogen. According to the presented results, it can be concluded that growing marvel grass variety of either GMG 1 or GAMG 2 with a higher level of nitrogen (N_3: 60 kg N/ha *i.e* 30 kg N/ha at basal and 30 kg N/ha after one month) reported higher total green fodder yield, dry matter yield and crude protein yield of marvel grass.

Future Scope Of The Study

Marvel grass (Dichanthium annulatum) is a highly preferred forage grass in India and is widely distributed on plains and hills up to 1500 m altitude. At present farmers of Gujarat as well India

is growing marvel grass for animal feed and fodder. Importance of marvel grass is increase specifically for milking animals under open grazing condition for that better scientific information and more work on nutritional as well as quality parameters will start so small and marginal farmers take advantage and increase green fodder and reduced shortfall.

Acknowledgment

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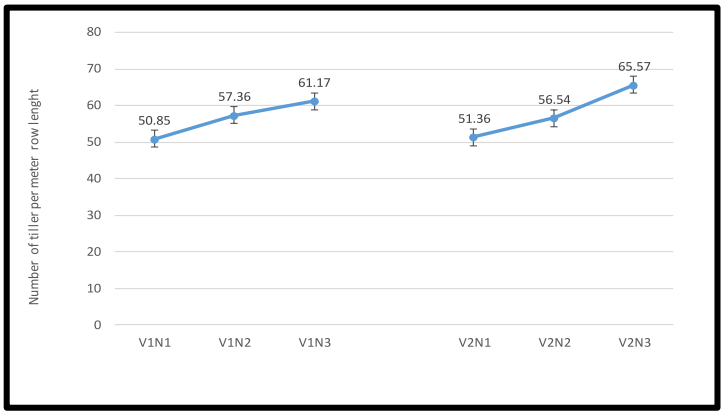

Fig : 2 Number of tillers per meter row length as influenced due to V×N interaction effect

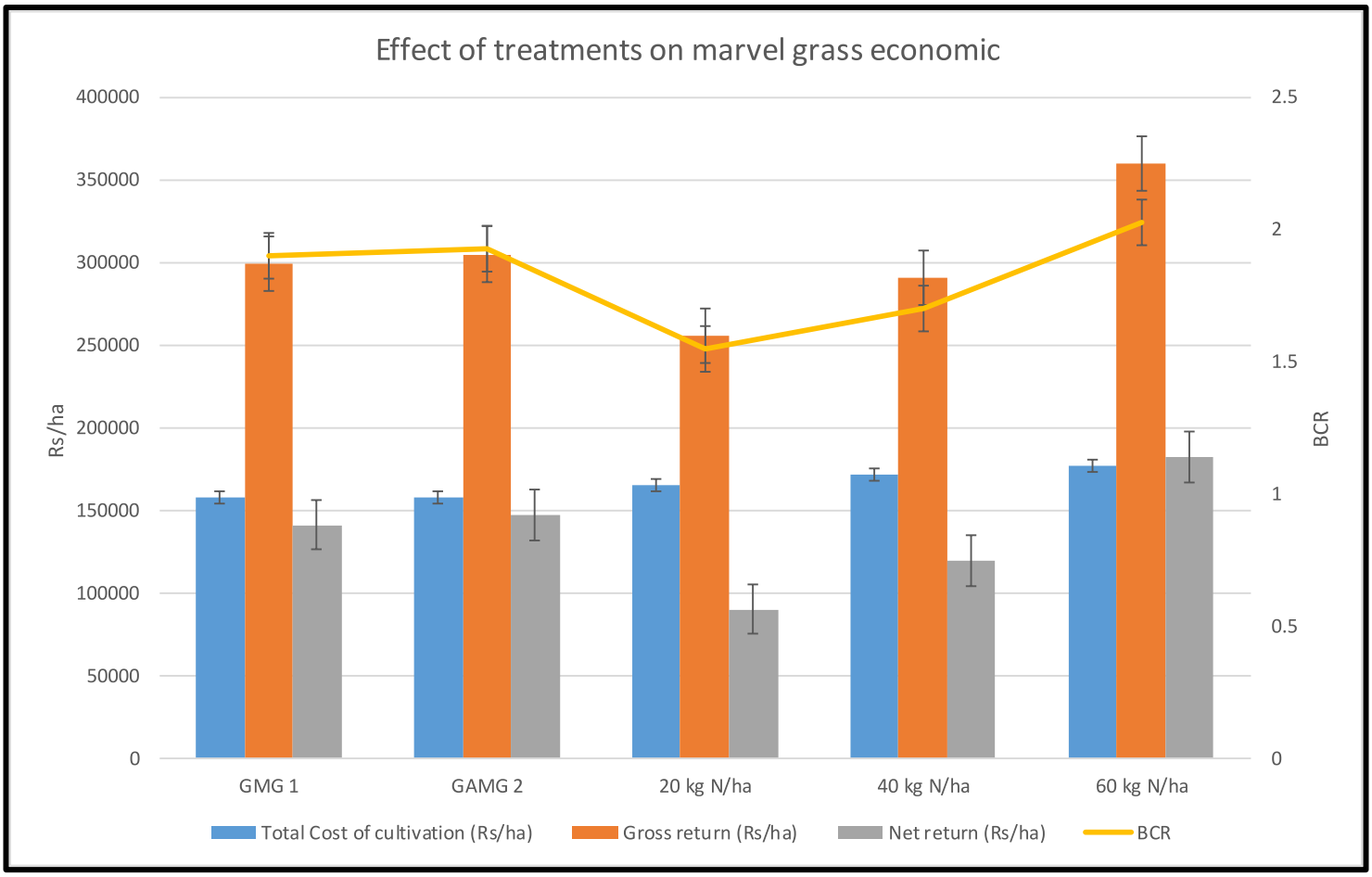

Fig. 01 Effect of varieties and levels of nitrogen on economics of marvel grass

Table 1 Effect of nitrogen levels on growth, yield, yield attributes and quality parameters of different marvel grass varieties

(Pooled of three year and total 18 cuts)

Treatment	Plant height (cm) at cutting	Numbers of titter per meter row length	Total GFY (q/ha)	Dry matter (%)	Total Dry matter yield (q/ha)	CP (%)	Total crude protein yield (q/ha)	ADF (%)	NDF (%)
Variety (V)									
V_1	84.76	56.46	1496	44.30	665	5.38	35.29	53.12	83.26
V_2	85.28	57.83	1526	44.37	680	5.49	36.86	52.99	82.31
S.Em.±	**1.79**	**0.57**	**25**	**0.29**	**13**	**0.04**	**0.75**	**0.29**	**0.42**
CD 5%	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Nitrogen level (N)									
N_1	79.93	51.11	1280	43.63	561	5.14	28.37	53.21	82.50
N_2	84.07	56.95	1455	44.62	653	5.39	34.73	52.97	82.82
N_3	91.06	63.37	1799	44.78	806	5.78	46.03	52.98	83.06
S.Em.±	**1.52**	**0.70**	**31**	**0.36**	**15**	**0.09**	**0.89**	**0.38**	**0.51**
CD 5%	**4.59**	**2.01**	**91**	**NS**	**44**	**0.37**	**2.69**	**NS**	**NS**
Interaction									
V × N	NS	Sig.	NS	NS	NS	NS	NS	NS	NS
Y × V	Sig.	NS	NS	NS	NS	NS	NS	NS	NS
Y× N	NS	NS	NS	NS	NS	Sig.	NS	NS	NS
Y× V × N	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	**6.08**	**6.04**	**5.71**	**3.95**	**6.67**	**4.48**	**7.37**	3.28	**3.02**

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