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Interaction Effect of FYM and Nitrogen Levels on Crude Protein and Nitrogen Content in Summer Fodder Pearl Millet

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ABSTRACT

An experiment was conducted during the summer season of 2020 at the college farm, Navsari Agricultural University, Navsari, to study the "Interaction effect of varieties, FYM and nitrogen levels on crude protein and nutrient content in summer fodder pearl millet under South Gujarat conditions." The experiment employed a factorial randomized block design with three replications, evaluating a total of twelve treatment combinations. These combinations included two varieties (V1: GAFB-4 and V2: GFB-1), two levels of FYM (F_1: control and F_2: 5.0 t FYM/ha), and three levels of nitrogen treatment (N_1: 75% RDN/ha, N_2: 100% RDN/ha, and N_3: 125% RDN/ha). Incorporation of 5.0 t FYM/ha significantly increased crude protein (7.54%) and nitrogen content (1.21%) compared to the control. Furthermore, applying 125% RDN/ha resulted in significantly higher crude protein (8.06%) and nitrogen content (1.29%) compared to the 75% RDN treatment. The interaction effect of FYM 5.0 t/ha + 125% RDN/ha recorded significantly the highest crude protein content (8.81%) and nitrogen content (1.41%) among all the treatment combinations.

Key Word: Crude protein, FYM, Fodder pearl millet, Interaction effect, Nitrogen

INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.) is a widely cultivated dryland crop known by various names such as Bajra, Bajri, Sajja, Combo, Candle millets, Horse millets, or Kambam. It is primarily grown in arid and semi-arid regions with low rainfall and sandy soils. Pearl millet is originated in tropical Africa and was later introduced into India. It thrives in soils with high salinity or lower pH and is a quick-growing, short-duration crop. Apart from its grain, pearl millet is valued for its stover and fodder production due to its tillering potential, drought and heat tolerance, and high dry matter yield. The stover of pearl millet serves as an important source of fodder, particularly in regions with low rainfall, accounting for 40-50% of the dry matter intake and being the primary feed source during dry months. Pearl millet's dual-purpose nature contributes to both food and fodder security in arid and semi-arid regions (Ramesh *et al*., 2006). Tiwana and Puri (2005) highlighted that fodder pearl millet is excellent for making silage, especially in regions where long dry spells occur during the rainy season, as it produces higher silage yields with higher protein content compared to sorghum.

The use of farmyard manure (FYM) aims to supply the required plant nutrients to sustain crop productivity while minimizing negative effects on soil health and the environment. By substituting part of the chemical fertilizer with locally available organic sources like FYM, losses and indiscriminate use of chemical fertilizers can be reduced. Nitrogen, being an essential constituent of proteins and chlorophyll, plays a critical role in promoting vegetative growth and early plant development. It also improves the quality of fodder by increasing protein content and influences the utilization of other elements like potassium and phosphorus. Proper nitrogen application is crucial to increase forage production and quality; however, excessive

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nitrogen use can lead to soil health degradation and the accumulation of toxic nitrate-N in fodder, harmful to animals. Thus, this investigation aimed to identify the maximum yielding optimal variety with the appropriate doses of FYM and nitrogen for summer forage pearl millet in South Gujarat.

MATERIALS AND METHODS

The field experiment was carried out during the summer of 2020 at the college farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat. The experimental soil was clayey in texture, with medium to poor drainage capacity, good water-holding capacity, and low availability of nitrogen (197.46 kg/ha) and organic carbon (0.44%). The available phosphorus was at a medium level (29.47 kg/ha) and available potassium was at a medium level (224.64 kg/ha). The soil had a neutral pH with normal electrical conductivity.

A total of twelve treatment combinations were evaluated, including two pearl millet varieties (V1: GAFB-4 and V2: GFB-1), two levels of FYM (F_1: control and F_2: 5.0 t FYM/ha) and three levels of nitrogen (N_1: 75% RDN/ha, N_2: 100% RDN/ha, and N_3: 125% RDN/ha). The spacing between pearl millet varieties was set at 30 cm, and sowing was done on February 20th, with harvesting on April 16th, 2020. Cultural practices and plant protection measures were applied following recommended guidelines. Nitrogen fertilizer was applied in two splits, with half the dose at sowing and the remaining half as a top dressing at 30 days after sowing. Stover yield data were recorded and converted to a hectare basis. A representative sample was taken separately from each net plot for estimation of N content in the plant. The samples were first air dry than oven-dried at 70°C ± 28.2 for 24 hrs, powdered by the mechanical grinder. The nitrogen content of fodder sample was determined by modified Kjeldahl method suggested by Jackson (1973).

RESULTS AND DISCUSSION

Effect of Farm yard manure

A perusal of the data (Table 1) revealed that the application of FYM significantly affected the crude protein content. Treatment F_1 (5.0 t FYM/ha) recorded significantly higher crude protein content (7.54%) compared to the control (6.58%). The probable reason might be the positive effect of FYM, as it serves as a source of primary, secondary and micronutrients for plant growth. It also acts as a constant source of energy for heterotrophic microorganisms, enhancing nutrient availability and crop quality. Similar results were also obtained by Kalra and Sharma (2015) in fodder maize, Meena and Meena (2012), and Sabhad *et al* (2020) in fodder sorghum.

The data (Table 2) showed that the nitrogen content of fodder pearl millet was significantly influenced by FYM application. An application of 5.0 t FYM/ha recorded higher nitrogen content (1.21%) in fodder pearl millet compared to the control. The increased nutrient content might be attributed to the improvement in soil physical condition and the balanced supply of macro and

Table 1. Crude Protein Content of Fodder Pearl Millet as Influenced by the Interaction Effect of FYM and Nitrogen Levels.

Treatment	Crude protein content (%)			Mean
	N_1: 75% RDN/ha	N_2: 100% RDN/ha	N_3: 125% RDN/ha	
F_0: Control	5.98	6.45	7.30	6.58
F_1: 5.0 t FYM/ha	6.24	7.55	8.81	7.54
Mean	6.11	7.00	8.06	
S. Em.±	0.21			
C.D. at 5%	0.61			

Table 2. Nitrogen Content of Fodder Pearl Millet as Influenced by the Interaction of FYM and Nitrogen Levels

Treatment	Nitrogen content (%)			Mean
	N_1: 75% RDN/ha	N_2: 100% RDN/ha	N_3: 125% RDN/ha	
F_0: Control	0.96	1.03	1.17	1.05
F_1: 5.0 t FYM/ha	1.00	1.21	1.41	1.21
Mean	0.98	1.12	1.29	
S. Em.±	0.03			
C.D. at 5%	0.10			

micronutrients to the crop due to FYM application. These findings were consistent with those reported by Meena and Meena (2012) in fodder sorghum and Kalra and Sharma (2015) and Kumar *et al* (2016) in fodder maize.

Effect of Nitrogen Level

The data (Table 1) revealed that with each successive increase in nitrogen levels, crude protein content also significantly increased. Treatment N_3 (125% RDN/ha) resulted in significantly higher crude protein content (8.06%) of fodder pearl millet compared to the other treatments. Conversely, the lowest crude protein content (6.11%) was recorded with the application of 75% RDN/ha. The higher protein content with the higher dose of nitrogen might be attributed to the fact that nitrogen is an essential constituent of chlorophyll, protoplasm, protein and nucleic acids and is needed for protein synthesis. These results were consistent with the findings of Raval *et al* (2015), Damame *et al* (2013), Kumawat *et al* (2016), Shekara *et al* (2019), and Parveen *et al* (2022).

The data (Table 2) indicated that nitrogen content in fodder pearl millet was significantly influenced by different nitrogen levels. An application of 125% RDN/ha resulted in the highest nitrogen content (1.29%), while treatment N_1 (75% RDN/ha) recorded significantly lower nitrogen content (0.98%) in fodder pearl millet. The probable reason for this difference might be that the soil was unable to supply sufficient nitrogen to the crop for optimum growth. The application of nitrogen fertilizer addressed this deficiency and resulted in an increased nitrogen content in plants. These results were in line with the findings of Meena and Meena (2012), Somashekar *et al* (2014), Singh and Sharma (2015), Chaudhary *et al* (2018) in sorghum, and Singh *et al* (2016) and Manjanagouda *et al* (2017) in fodder pearl millet.

Interaction Effect

The mean data (Table 1) indicates that the interaction effect of the application of FYM and nitrogen levels was found to be significant for crude protein content. The treatment combination F_1N_3 (5.0 t FYM/ha along with 125% RDN/ha) recorded the significantly highest crude protein content of 8.81% among all treatments. Additionally, the treatment combination F_1N_2 showed remarkably higher crude protein content (7.55%), which was comparable to F_0N_3. The lowest crude protein content (5.98%) was observed with the treatment combination F_0N_1. This might be due to the combined application of inorganic and organic sources of nutrients, facilitating the dissolution and solubilisation of nutrients in the soil and making them more available to the plant's rhizosphere. Consequently, the nitrogen content in the plant increased, contributing to higher protein content. The results of the experiment were consistent with the findings of Hamdy *et al* (2015) in fodder sorghum and Hoda *et al* (2015) in fodder pearl millet.

The perusal of data (Table 2) observed that nitrogen content in fodder pearl millet remarkably

differed with the interaction of FYM and nitrogen application. An application of FYM 5.0 t/ha along with 125 % RDN/ha recorded significantly the highest nitrogen content (1.41 %) over rest of treatment combination. Significantly the lowest N content was observed under treatment combination $F0N_1$ (0.96 %), which was at par with F_0N_2 and F_1N_1. This might be due to application of both sources of nutrients viz., inorganic and organic helps in continuously availability of nutrients by dissolving and solubilizing it in soil solution and there by more ease of use of nutrients from rhizosphere by plant, and ultimately nitrogen content in plant is increase. The results were in line with those of Hamdy *et al* (2015) in fodder sorghum, Hoda *et al* (2015) in fodder Pearl millet and Sathya *et al* (2022) in cotton.

CONCLUSION

In conclusion, it was evident that under South Gujarat Agro-climatic conditions, summer fodder pearl millet should be fertilized with 125% RDN/ha along with 5.0 t FYM/ha to achieve higher quality and nutrient contents Top of Form.

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