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Yield and qualitative evaluation of fodder pearl millet (*Pennisetum glaucum*) varieties under different fertility levels

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Abstract
Animal nutrition including green fodder plays an important role in livestock productivity but the productivity of livestock is low under arid conditions due to green fodder deficiency. Therefore, an experiment was conducted on fodder pearl millet crop during *kharif* season of 2018 at College of Agriculture, Swami Keshwan and Rajasthan Agricultural University, Rajasthan, India. The treatments consisted of four fertility levels *(*0, 40, 80 and 120 kg N/ha) and three varieties (Raj bajra -1, Raj- 171 and Local). The experiment was laid out in factorial randomized block design with three replications. The productivity of crops was evaluated in terms of green and dry fodder yield and quality in the form of dry matter, ash, crude protein, ether extract, crude fibre, total digestible nutrients, dry matter intake and dry matter digestibility values. Results revealed that total green fodder and dry matter yield was higher in variety Raj bajra-1 as compared to Raj 171 and Local variety. Among nutrient management, treatment80 kg N + 40 kg P_2O_5/ha recorded higher fodder production as well as fodder quality as compared with control and 40 kg N + 20 kg P_2O_5/ha being statistically at par with 120 kg N + 60 kg P_2O_5/ha.

Keywords: Greenfodder yield, dry fodder yield, ether extract, ash content and crude fibre

Introduction
India has a livestock population of 535.8 million, which is the largest in the world (Bhakar *et al.*, 2020) [2]. This sizeable livestock population plays a multitude of roles of ensuring food security, poverty alleviation, evading climate change and engaging women in agriculture in a large number (Smith *et al.*, 2013) [14]. Despite India's large livestock population and its global position with highest milk production; the productivity of Indian cattle is low compared to the global average. The reason can be many; from improper and inadequate nutrition to breeding and lack of adaptability problem (Bhakar *et al.*, 2020) [2]. The release is significant given that India has a shortage of 284 million tonnes of green fodder and 122 million tonnes of dry fodder. This demand is likely to grow further and India would require 400 and 117 million tonnes of green and dry fodder, respectively, by year 2025. According to National Institute of Animal Nutrition and Physiology, from 1980 to 2011, dry matter availability from green fodder was increased by 15 per cent only, whereas dry matter availability from crop residues and concentrates doubled and tripled respectively. If we assume that area under fodder crops will increase from 4 per cent to 5 per cent of gross cropped area, with no decline in the area under pasture and forest, DM availability from green fodder will be 220 MT in 2030. Thus, we arrive at an estimate of about 832 MT of Dry matter from all the three resources, which will be enough to carry a livestock population of 300 million ACUs. But for bringing uncultivated land under fodder cultivation under limited inputs careful crop and variety selection is required. For the low rainfall conditions as of Rajasthan pearl millet can be the best choice.
Pearl millet (*Pennisetum glaucum* L.) is a tall, warm season annual plant locally known as Bajra, belongs to grass family known as poaceae. It is a very important dual-purpose summer crop grown for both fodder and grain. It is also grown and used for hay, pasture, silage, seed crop, food, building material and fuel. It is a fast growing, short duration, drought tolerant crop having high biomass production potential, tillering and ratooning ability with high protein content (10-12 per cent) free from making it as an outstanding fodder crop for the rainfed situations and serves as an ideal crop under regions of low rainfall conditions. Its green forage (without prussic acid, a poisoning potential commonly found in sorghum and Sudan grass) is a valuable feed for livestock (Yusuf *et al.*, 2012) [16] as it is leafy, palatable and very nutritious

feed stock ensuring good milk yield. Additional benefit with pearl millet is that, it can be grazed or cut and fed at any growth stage. Also, it can grow up to 6 to 10 feet height as conditions of high temperatures and favourable moisture prevails (Faridullah *et al.*, 2010) [6].

Adoption of significant varieties and improved crop management practices is required for sustaining fodder availability to animals in Rajasthan (Sharma, 2013) [11]. Improved crop management practices including nutrient application is required for enhancing yield and quality of fodder crops as like for other crops. Among the nutrients, nitrogen and phosphorus are essential primary nutrients for profuse vegetative growth and play a pivotal role in productivity and quality of forage like crude protein, crude fibre, total ash and ether extractable fat *etc*. Nitrogen is the key element and major constituents of protein and nucleic acid which favours the synthesis of protoplasm in plant body, promotes photosynthesis, size of plant, yield contributing characters and yield of crops (Meena *et al*., 2012). Under arid conditions of Rajasthan nutrient supplementation can enhance fodder pearl millet productivity and quality. Therefore, standardization of optimum dose of fertilizer is required to get maximum forage yield with better quality traits (Tamta *et al*., 2019) [15]. Seeing the non-availability of literature regarding standardization of fertilizer dose for fodder pearl millet in Rajasthan, a field experiment entitled evaluation of fodder pearl millet varieties under different fertility levels for qualitative fodder production was carried out.

Materials and Methods

An experiment was conducted on fodder pearl millet during *kharif* season of 2018 at Instructional Farm, College of Agriculture, Swami Keshwan and Rajasthan Agricultural University, Bikaner, Rajasthan, India which is situated at 28º01'N latitude and 73º22'E longitude at an altitude of 234.70 meters above mean sea level, in arid western hyper arid zone of Rajasthan. According to the average meteorological data of 2018 (June to October), the maximum temperature ranged between 35.0 ºC and 40.9 ºC during the crop growing season in the 30th and 28th standard meteorological weeks, respectively. Likewise, the values of minimum temperature *i.e.*, 16.7 ºC and 29.9 ºC was recorded in the 43th and 28th standard meteorological weeks, respectively. Crop received 279.2 mm of rainfall with 13 rainy days in the growing season. Pan evaporation ranged from 1.1 to 9.4 mm/day during the crop growing period. The average relative humidity during experiment fluctuated in the range of 19.7 to 91.9 per cent. The bright sun shine hours during experiment fluctuated in the range of 4 to 9.7 hours. The soil of the experimental site was sandy loam in nature, having pH 8.13, electrical conductivity 0.20 dS/m, organic carbon 0.18 per cent and available N, P and K were 120, 16.20 and 175.70 kg/ha, respectively.

The experiment was laid out in randomized block design (Factorial) with three replications. The treatments consisted of four fertility levels (N + P_2O_5 Kg/ha) *viz.* 0, 40 + 20, 80 + 40 and 120 + 60 and three varieties *viz.* Raj bajra-1, Raj-171 and Local variety. Sowing of fodder pear millet varieties were done manually with Kera method on 28 June 2018 with the onset of monsoon rain at row spacing of 30 cm using seed rate of 10 kg/ha. The nitrogen and phosphorus were applied as per treatments through urea and DAP. Full dose of phosphorus and half dose of nitrogen were applied at the time of sowing by drilling and remaining nitrogen was applied in two split doses at 30 DAS and after 1st cutting through broadcasting. Other agronomic crop cultivation practices were followed as per recommendations for the region.

For green fodder, crop was harvested at 55 and 95 DAS. Then crops were harvested from each net plot area individually, tagged and weighed. Weight was recorded and expressed in kg/ha and then converted into green fodder yield (q/ha). Dry matter yield (q/ha) was taken from samples of fresh weight after complete drying or on the basis of the moisture content in biomass at cutting, putting sample in oven at 72 ºC for 24 h. Dried fodder was used for analysing the forage nutritive value in term of crude protein (CP) using standard method (A.O.A.C, 1990) [1]. Total digestible nutrient was calculated by the crude protein, crude fat, crude fibre and nitrogen free extract for each treatment. Data were processed in Microsoft excel 2010 and analyzed by using SPSS 19.0 Version. The least significant difference test was used to compare among different treatments at 5% level of significance ($P< 0.05$).

Results and Discussion

Results depicted that nitrogen and phosphorus levels along with different varieties in fodder pearl millet influenced the green fodder, dry fodder yield and green fodder productivity. Raj bajra -1 recorded the highest green fodder (224.62, 164.92 q/ha), dry fodder yield (55.27, 48.68 q/ha) and green fodder productivity (4.10q/ha day^{-1}) at 1st cutting and 2nd cutting respectively, as compared to Raj- 171 and Local variety (Table 1). This might be due to the superiority of the genotype to produce more values of growth characteristics like plant height, leaf area index, leaf: shoot ratio and number of tillers meter^{-1} row length. Similar results were also reported by Damame *et al*. (2013) [4], Midha *et al.* (2015) [9] and Kumawat *et al*. (2017) [7]. In case of different fertility levels significant increase in green fodder, dry fodder yield and green fodder productivity was obtained when the crop was fertilized with 120 kg N + 60 kg P_2O_5/ha compared with control, 40 kg N + 20 kg P_2O_5/ha but at par with 80kg N + 40 kg P_2O_5/ha. Hence the productivity increased with increasing levels of nutrient application. Similar results were also obtained by Singh *et al.* (2012) [13] and Bhakar *et al.* (2021) [3].

Evaluation of different quality parameters revealed that Raj bajra-1 recorded significantly higher ether extract content (3.03, 2.49%) ash content (11.07, 9.90%) and crude fibre content (26.50, 24.22%), and less amount of nitrogen free extract than rest of varieties at 1st cutting and 2nd cutting respectively (Table 2 and 3).Similar results were also reported by Singh *et al.* (2012) [13] and Kumawat *et al*. (2017) [7] as it provides better palatability and acceptability for animals. Crude protein and total digestible nutrient were not influenced by varieties but the increase in crude protein contents with increasing fertility levels may be the result of enhancement in amino acid formation. The present findings are in conformity with those of Devi and Padma (2007) [5].

Nitrogen and phosphorus fertilization not only enhanced the growth and yield of fodder pearl millet but also improved quality of fodder by increasing the Ash, EE and CP content. Increase in Ash (10.77, 9.75%) and EE content (3.15, 2.55%), CP content (11.86, 9.28%) and CF content (25.07, 23.42%) of fodder pearl millet was observed up to 80 kg N + 40 kg P_2O_5/ha at 1st cutting and 2nd cutting respectively (Table 2 and 3). The higher amount of chloroplast and other pigments at early age of the plant might have also attributed to higher

crude fat content at early stage. Deposition of structural carbohydrates in plant during later stages may also be one of the other reasons. Sheoran *et al*. (2008) [12], Singh *et al.* (2012) [13] and Meena *et al*. (2013) [8] also reported similar results. Increasing nitrogen and phosphorus fertilization of pearl millet increased the availability of nitrogen in the rhizosphere and since nitrogen is main constituent of amino acids, it ultimately increased crude protein content of plant. Application of nitrogen and phosphorus had depressing effect on CF and NFE content because it resulted in increased leaf weight and wider leaf: shoot ratio which might had decreased the CF content in fodder pearl millet. In control treatment maximum CF and NFE content was recorded and which was significantly higher over 120 kg N + 60 kg P_2O_5/ha, 80 kg N + 40 kg P_2O_5/ha and 40 kg N + 20 kg P_2O_5/ha at the both cutting stage. This could be attributed to the fact that nitrogen and phosphorus application at higher doses had significant effect on CP content thereby reducing the proportion of carbohydrates.

Table 1: Effect of different fertility levels on green fodder yield (GFY), dry fodder yield (DFY) and per day green fodder productivity GFP of fodder pearl millet

Treatment	GFY (q/ha)			DFY (q/ha)			GFP (q/day/ha)
Varieties	**1st cutting**	**2nd cutting**	**Total**	**1st cutting**	**2nd cutting**	**Total**	
Raj bajra 1	224.62	164.92	389.54	55.27	48.68	103.95	4.10
Raj171	189.37	159.31	348.68	50.32	42.79	93.11	3.67
Local	182.87	159.31	348.68	47.50	40.72	88.21	3.67
S.Em±	2.05	1.57	3.16	0.58	0.53	0.84	0.03
CD (P=0.05)	6.02	4.59	9.27	1.71	1.55	2.47	0.10
Fertility levels (N + P_2O_5 kg/ha)							
Control	157.13	105.50	262.63	40.84	35.38	76.22	2.76
40 + 20	199.87	162.43	362.30	49.35	41.44	90.79	3.81
80 + 40	216.72	182.30	399.01	56.47	48.80	105.27	4.20
120 + 60	222.09	188.33	410.43	57.45	50.62	108.07	4.32
S.Em±	2.74	2.09	4.22	0.78	0.70	1.12	0.04
CD (P=0.05)	8.02	6.12	12.37	2.28	2.07	3.29	0.13

Table 2: Effect of different fertility levels on ether extract and ash content of fodder pearl millet

Treatment	Ether extract (%)		Ash (%)		Crude fibre (%)	
	1st cutting	**2nd cutting**	**1st cutting**	**2nd cutting**	**1st cutting**	**2nd cutting**
Varieties						
Raj bajra 1	3.03	2.49	11.07	9.90	26.50	24.22
Raj 171	2.91	2.39	10.15	9.16	25.72	23.81
Local	2.80	2.30	9.65	8.68	23.37	22.48
S.Em±	0.02	0.03	0.11	0.09	0.16	0.14
CD (P=0.05)	0.06	0.09	0.31	0.27	0.47	0.40
Fertility levels (N + P_2O_5 kg/ha)						
Control	2.41	1.97	9.30	8.25	25.62	24.07
40 + 20	2.88	2.40	9.91	8.95	25.55	23.45
80 + 40	3.15	2.55	10.77	9.75	25.07	23.42
120 + 60	3.20	2.65	11.18	10.04	24.55	23.19
S.Em±	0.03	0.04	0.14	0.12	0.21	0.18
CD (P=0.05)	0.08	0.12	0.42	0.36	0.63	0.53

Table 3: Effect of different fertility levels on crude protein (CP), nitrogen free extract (NEF) and TDN content of fodder pearl millet

Treatment	CP (%)		NFE (%)		TDN (%)	
	1st cutting	**2nd cutting**	**1st cutting**	**2nd cutting**	**1st cutting**	**2nd cutting**
Varieties						
Raj bajra 1	11.44	8.97	47.95	54.43	60.68	61.28
Raj 171	11.40	8.96	49.82	55.67	61.26	62.15
Local	11.37	8.89	52.82	57.58	61.93	62.59
S.Em±	0.04	0.06	0.20	0.20	0.49	0.49
CD (P=0.05)	NS	NS	0.59	0.57	NS	NS
Fertility levels (N + P_2O_5 kg/ha)						
Control	10.35	8.26	52.31	57.45	61.22	62.17
40 + 20	11.44	8.82	50.23	56.38	61.42	62.13
80 + 40	11.86	9.28	49.14	55.00	61.07	61.87
120 + 60	11.97	9.39	49.11	54.73	61.46	61.86
S.Em±	0.05	0.08	0.27	0.26	0.65	0.66
CD (P=0.05)	0.15	0.23	0.78	0.76	NS	NS

NS: Not Significant

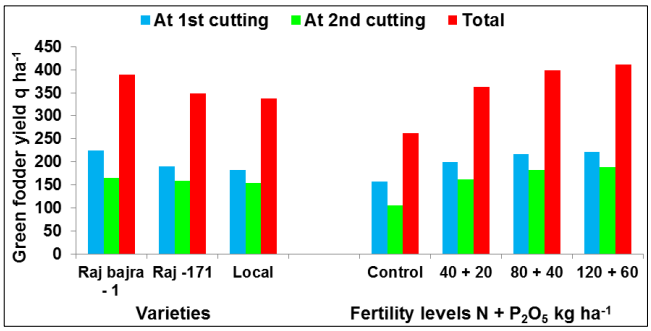

Fig 1: Effect of different fertility levels on green fodder yield of fodder pearl millet

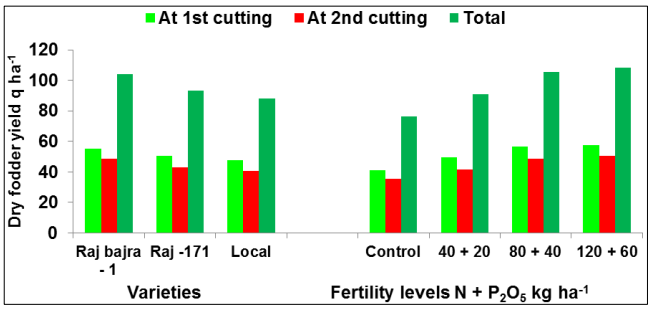

Fig 2: Effect of different fertility levels on dry fodder yield of fodder pearl millet

Conclusion

From the above findings, it could be concluded that fodder pearl millet variety Raj bajra-1 gave significantly higher fodder yield (green and dry) and green fodder productivity along with good quality of fodder using the fertilizer dose of 80 kg N and 40 kg P_2O_5/ha. For future line of work dual purpose pearl millet varieties can be explored under integrated nutrient management practices for sustaining fodder production along with soil health.

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References

1. AOAC. Official methods of analysis, 15th edition. Association of Official Analytical Chemists, Washington, DC, 1990.
2. Bhakar A, Singh M, Kumar S, Dutta S, Mahanta RK, Onte S *et al*. Ensuring nutritional security of animals by mixed cropping of sorghum and guar under varying nutrient management. Indian Journal of Animal Nutrition. 2020;37(1):48-56.
3. Bhakar A, Singh M, Kumar S, Meena RK, Meena BL, Kumar R *et al*. Growth, productivity and profitability of fodder sorghum and cluster bean as influenced by mixed cropping and nutrient management. Legume Research, 2021. Advanced online publication. https://doi.org/10.18805/LR4353.
4. Damame SV, Bhingarde RN, Pathan SH. Effect of different nitrogen levels on nutritional quality and nitrate nitrogen accumulation in forage pearl millet genotypes grown under rainfed conditions. Forage Research. 2013;39(2):93-95.
5. Devi KBS, Padmaja G. Response of forage pearl millet varieties to different nitrogen levels. Forage Research. 2007;33(3):185-187.
6. Faridullah, Alam A, Irshad M, Khan J, Khan AR, Sher H *et al*. Comparative studies of different pearl millet varieties as affected by different yield components. Electronic Journal of Environmental, Agricultural and Food Chemistry. 2010;9:1524-33.
7. Kumawat SM, Khinchi V, Meena RK, Rakesh S. Growth characters, fodder yield, quality and economics of pearl millet genotype as influenced by nitrogen levels. International Journal of Pure and Applied Bioscience. 2017;5(3):449-453.
8. Meena SN, Jain KK. Effect of varieties and nitrogen fertilization on fodder pearl millet (*Pennisetum glaucum*) in North Western Rajasthan. Indian Journal of Agronomy. 2013;58(2):262-263.
9. Midha LK, Arya S, Kumari P, Joshi UN. Performance of forage pearl millet genotypes under different nitrogen levels. Forage Research. 2015;41(2):137-138.
10. Patel SJ, Patel MD, Patel JH, Patel AS, Gelani RN. Role of women gender in livestock sector: A review. J. Livest. Sci. 2016;7:92-96.
11. Sharma NK. Fodder strategy for sustainable animal production in arid Rajasthan. Annals of Arid Zone. 2013;52(2):95-102.
12. Sheoran RS, Tiwana US, Yadav NS, Joshi UN. Evaluation of promising forage pearl millet (*Pennisetum glaucum*) varieties for fodder and seed production with different nitrogen levels under varying environments. Forage Research. 2008;33(4):206-211.
13. Singh B, Rana DS, Joshi UN, Dhaka AK. Fodder yield and quality of pearl millet genotypes as influenced by nitrogen levels. Forage Research. 2012;38(1):62-63.
14. Smith J, Sones K, Grace D, MacMillan S, Tarawali S, Herrero M. Beyond milk, meat, and eggs: Role of livestock in food and nutrition security. Anim. Front. 2013;3:6-13.
15. Tamta A, Kumar R, Ram H, Meena RK, Meena VK, Yadav MR *et al*. Productivity and profitability of legume-cereal forages under different planting ratio and nitrogen fertilization. Legume Research-An International Journal. 2019;42(1):102-107.
16. Yusuf MJ, Nabi G, Basit A, Husnain SK, Akhtar LH. Development of High Yielding Millet Variety Sargodha Bajra-2011 Released for General Cultivation in Punjab Province of Pakistan. Pakistan Journal of Agricultural Sciences. 2012;49:275-282.