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Influence of FYM and vermicompost on pearl millet based intercropping in semi arid region of Rajasthan

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Abstract
Pearl millet is a nutritious grain widely grown in India, especially in Rajasthan, due to its resilience to poor soil and arid conditions. To improve yield sustainably, intercropping pearl millet with legumes is an emerging strategy. Since legumes can partially meet pearl millet's nutritional requirements, they create opportunities for using organic nutrient sources. Utilizing organic sources of nutrients is essential for sustaining long-term productivity in these intercropping systems without harming the ecosystem. In the light of above facts, a field experiment was conducted during *kharif* season 2022 at instructional farm, Department of Agronomy, SKNCOA, Jobner, Rajasthan (26˚05' N latitude, 75˚20' E longitude and at an altitude of 427 m above mean sea level). The experiment was laid out in split plot design with four main plot treatments (intercropping) and six sub plot treatments (organic amendments) were replicated thrice. The results revealed that the grain yield of PM was 11%, 20.62% and 26.20% superior over PM+CB, PM+MB and PM+CP, respectively while among organic amendments the significantly higher grain yield was obtained FYM+VC (1:1) which was at par with FYM+VC (1:3). Similar trend was observed in stover and biological yield. Therefore, it can be concluded that the PM when supplemented with FYM+VC in equal proportions noted significantly higher yield and yield attributes compared to other treatment combinations in semi arid regions of Rajasthan.

Keywords: Intercropping, organic amendments, yield attributes and yield

Introduction

Millets, known for their high nutritional content, are frequently grown in poor-quality soils and challenging weather conditions. Pearl millet (*Pennisetum glaucum* L.) ranks as the third-largest food grain crop in India. It is rich in protein (12.6%), minerals, iron (2.8%), and fat (5%) (Anonymous, 2014) [3]. Rajasthan leads in terms of both area and production of pearl millet. Aside from being a staple food for nearly 10% of India's population, pearl millet is also a crucial fodder crop (Manga *et al.*, 2011) [9]. Its drought resistance and efficient use of solar radiation make it well-suited for arid regions and less fertile soils.

In India, pearl millet is cultivated on 7.57 million hectares, producing 11.43 million tonnes, with a productivity rate of 1510 kg/ha (Anonymous, 2021) [2]. Specifically, in Rajasthan, pearl millet covers 4.3 million hectares, yielding 5.8 million tonnes with an average productivity of 1337 kg/ha (Anonymous, 2020-21) [1, 2]. Rajasthan, a state characterized by arid and semi-arid climates and difficult soil conditions, stands out as a major pearl millet producer. Pearl millet is often grown as a rain-fed crop on marginal and sub-marginal lands in Rajasthan, with light-textured soils that are low in nitrogen, phosphate, and organic matter. These soils have limited moisture retention capacity, leading to poor crop growth and unprofitable yields.

To meet the growing food demand driven by the rapidly increasing population, modern agricultural systems have explored various strategies to achieve high yields (Karim, 2013) [6]. Most of these methods focus on enhancing the utilization of resources such as water, nutrients, land, solar radiation, and atmospheric carbon dioxide (Ausiku *et al.*, 2020) [4]. However, improper use of these resources is causing them to deplete, which threatens agricultural productivity. Sustainable resource utilization is essential for improving resource productivity in this context. Intercropping is a resource-use strategy that can withstand such conditions.

Considering this, research on intercropping millets with legumes is gaining traction to improve resource efficiency. Pearl millet typically forms a taller canopy than legume crops, indicating that component crops may utilize environmental resources differently in both time and space (Maitra, 2020) [8]. Several studies have demonstrated that intercropping pearl millet with legumes optimizes the use of light, moisture, and nutrients in relation to space and time.

Since legumes can partially meet pearl millet's nutritional requirements, they create opportunities for using organic nutrient sources. Utilizing organic sources of nutrients is essential for sustaining long-term productivity in these intercropping systems without harming the ecosystem (Timsina, 2018) [10]. Given the scarcity of research on the influence of different proportions of FYM and vermicompost on pearl millet intercropped with legumes, this study aims to address that gap.

Materials and Methods

A field experiment was conducted during *kharif* season 2022 at instructional farm, Department of Agronomy, SKNCOA, Jobner, Rajasthan (26˚05' N latitude, 75˚20' E longitude and at an altitude of 427 m above mean sea level). The region was characterized by semi arid climate and during the period of experimentation the maximum temperature ranged between 30.2 °C to 42.2 °C, minimum temperature ranged between 16.8 °C to 25.7 °C with a total rainfall of 546.05 mm. The soil in the experimental plot was loamy sand in texture with low organic carbon and available nitrogen while medium in available phosphorus and potassium. The experiment was laid out in split plot design with four main plot treatments and six sub plot treatments (Table 1) were replicated thrice. All the observations recorded during the experiment were statistically analyzed by F-test at 5 percent level of significance (Gomez and Gomez, 1984) [5].

Table 1: Treatment details

Main plot treatments: Intercropping (04)	
M1	PM
M2	PM+CP
M3	PM+MB
M4	PM+CB
Subplot treatments: Organic amendments (06)	
S1	No application
S2	FYM
S3	VC
S4	FYM+VC (3:1)
S5	FYM+VC (1:1)
S6	FYM+VC (1:3)

Note: PM: Pearl millet; CP: Cowpea; MB: Mung bean; CB: Clusterbean; FYM: Farm yard manure; VC: vermicompost

Results and Discussion

Number of ear heads/m row length

The data in Table 2 showed that the intercropping and organic amendments significantly influenced the number of ear heads/m row length of pearlmillet Among the intercropping, significantly maximum number of ear heads/m row length of pearlmillet was noted by pearlmillet while the lowest number of ear heads/m row length was noted by PM + CP. Moreover, the latter treatment remained on par with PM + MB intercropping.

Among the intercropping and amendments, significantly maximum number of ear heads/m row length of pearlmillet was reported by application of FYM+VC (1:1) which remained statistically comparable with application FYM+VC (1:3) while, the lowest number of ear heads/m row length of pearlmillet was recorded by no application. The interaction effect between intercropping and organic amendments in terms of number of ear heads/m row length of pearlmillet noted to be non significant.

Ear head length (cm)

The data in Table 2 showed that the intercropping and organic amendments significantly influenced the ear head length of pearlmillet. Among the intercropping, significant ear head length of pearlmillet was noted by PM which remained on par with PM + CB while the lowest ear head length was noted by PM + CP.

Among the organic amendments, significantly maximum ear head length of pearlmillet was reported by application of FYM + VC (1:1) which remained statistically comparable with application of FYM + VC (1:3) while, the lowest ear head length of pearlmillet was recorded by no application.

Ear head girth (cm)

The data in Table 2 showed that the intercropping and organic amendments did not influence the ear head girth of pearlmillet. Among the intercropping, numerically the highest ear head girth of pearlmillet was noted by PM while numerically the lowest ear head girth was noted by PM + CP. Among the organic amendments, numerically the highest ear head girth of pearlmillet was reported by application of FYM + VC (1:1) while, numerically the lowest ear head girth of pearlmillet was recorded by no application.

Number of grains/ear head

The data in Table 2 showed that the intercropping and organic amendments significantly influenced the number of grains/ear head of pearlmillet. Among the intercropping, significantly maximum number of grains/ear head of pearlmillet was noted by PM while the lowest number of grains/ear head was noted by PM + CP intercropping. Among the organic amendments, significantly maximum number of grains/ear head was reported by application of FYM + VC (1:1) which remained statistically comparable with application of FYM + VC (1:3) while, the lowest number of grains/ear head of pearlmillet was recorded by no application.

Test weight (g)

The data in Table 2 showed that the intercropping and organic amendments did not influence the test weight of pearlmillet.

Among the intercropping, numerically the highest test weight was noted by PM while organic amendments, numerically the highest test weight was reported by application of FYM.

Grain yield (t/ha)

The data in Table 3 showed that the intercropping and organic amendments significantly influenced the grain yield of pearlmillet. Among the intercropping, significant grain yield of pearlmillet was noted by PM while the lowest was noted by PM + CP intercropping.

Among the organic amendments, significantly higher grain yield of pearlmillet was reported by application of FYM + VC (1:1) which remained statistically comparable with application of FYM + VC (1:3) while, the lowest grain yield of pearlmillet was recorded by no application.

Table 2: Effect of organic amendments on yield attributes of pearl millet under different pearlmillet - legumes intercropping

Treatment	No. of ear heads/m row length	Ear head length (cm)	Ear head girth (cm)	No. of grain/ear head	Test weight (g)
Intercropping					
PM	21.06	28.01	9.30	939	8.13
PM+CP	15.66	24.22	8.70	674	7.94
PM+MB	16.49	25.01	8.88	775	7.89
PM+CB	18.17	26.25	9.09	800	8.01
SEm ±	0.45	0.57	0.20	19.04	0.18
CD (P=0.05)	1.54	1.98	NS	65.89	NS
Organic Amendments					
No application	13.63	21.94	8.41	576	7.91
FYM	16.15	23.54	8.98	684	8.06
VC	19.27	27.45	9.10	864	8.02
FYM+VC (3:1)	17.18	25.44	9.05	773	7.97
FYM+VC (1:1)	20.97	28.86	9.28	966	8.03
FYM+VC (1:3)	19.88	27.99	9.14	920	7.96
SEm ±	0.51	0.54	0.20	21.68	0.15
CD (P=0.05)	1.47	1.55	NS	61.97	NS

Stover yield (t/ha)

The data in Table 3 showed that the intercropping and organic amendments significantly influenced the stover yield of pearlmillet. Among the intercropping, significantly higher stover yield of pearlmillet was noted by PM which was statistically comparable with PM + CB intercropping.

Among the organic amendments, significantly higher stover yield of pearlmillet was reported by application of FYM + VC (1:1) which remained statistically comparable with application of FYM + VC (1:3) while, the lowest stover yield of pearlmillet was recorded by no application.

Biological yield (t/ha)

The data in Table 3 showed that the intercropping and organic amendments significantly influenced the biological yield of pearlmillet. Among the intercropping, significantly higher biological yield of pearlmillet was noted by PM. The lowest biological yield was noted by PM + CP which remained on par with PM + CP intercropping. However, the latter did not exhibit statistical comparability with respect to pooled data.

Among the organic amendments, significantly higher biological yield of pearlmillet was reported by application of FYM + VC (1:1) which remained statistically comparable with application of FYM + 75 (1:3). The lowest biological yield of pearlmillet was recorded by no application.

Harvest index (%)

The data in Table 3 showed that the intercropping and organic amendments significantly influenced the harvest index of pearlmillet. Among the intercropping, significantly higher harvest index of pearlmillet was noted by PM. The lowest harvest index was noted by PM + CP intercropping which was statistically comparable with PM + MB intercropping.

Among the organic amendments, significantly higher harvest index of pearlmillet was reported by application of FYM + 75 (1:3) The lowest harvest index of pearlmillet was recorded by no application.

Table 3: Effect of organic amendments on yield of pearlmillet under different pearlmillet - legumes intercropping

Treatment	Grain yield (t/ha)	Stover yield (t/ha)	Biological yield (t/ha)	Harvest index (%)
Intercropping				
PM	1.83	3.85	5.68	32.21
PM+CP	1.36	3.22	4.58	29.56
PM+MB	1.45	3.37	4.83	29.74
PM+CB	1.65	3.57	5.22	31.57
SEm ±	0.04	0.08	0.08	0.78
CD (P=0.05)	0.13	0.29	0.29	2.70
Organic Amendments				
No application	1.07	2.84	3.91	27.24
FYM	1.44	3.17	4.61	31.09
VC	1.71	3.72	5.43	31.41
FYM+VC (3:1)	1.58	3.44	5.02	31.52
FYM+VC (1:1)	1.84	3.99	5.83	31.59
FYM+VC (1:3)	1.80	3.85	5.65	31.78
SEm ±	0.04	0.08	0.09	0.76
CD (P=0.05)	0.12	0.23	0.26	2.18

Conclusion

From the study, it can be concluded that the PM when supplemented with FYM+VC in equal proportions noted significantly higher yield and yield attributes compared to other treatment combinations in semi arid regions of Rajasthan.

References

1. Anonymous, Rajasthan Agricultural Statistics at a Glance, Commissionerate of Agriculture, Rajasthan, Jaipur. Rajasthan Agricultural Statistics at a Glance; c2020-21.
2. Anonymous, Agricultural statistics at a glance, Department

of Agriculture Cooperation and Farmers Welfare, Directorate of Economics and Statistics, Government of India. Agricultural Statistics at a Glance; c2021.

3. Anonymous, 14th National Food Security Mission Executive Committee (NFSMEC) Meeting, Director of Agriculture Gujarat State, Gandhinagar, Gujarat; c2014.
4. Ausiku AP, Annandale JG, Steyn JM, Sanewe AJ. Improving pearl millet (Pennisetum glaucum) productivity through adaptive management of water and nitrogen. Water. 2020;12(2):422. https://doi.org/10.3390/w12020422.
5. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd ed. Los Baños (PH): International Rice Research Institute; New York: John Wiley & Sons; c1984. p. 324.
6. Karim AZ. Impact of a growing population on agricultural resource management: exploring the global situation with a micro-level example. Asian Soc Sci. 2013;9(15):14-23.
7. Kebede E. Contribution, utilization, and improvement of legumes-driven biological nitrogen fixation in agricultural systems. Front Sustain Food Syst. 2021;5:767998. https://doi.org/10.3389/fsufs.2021.767998.
8. Maitra S. Intercropping of small millets for agricultural sustainability in drylands: A review. Crop Res. 2020;55(3-4):162-171.
9. Manga VK, Kumar A. Cultivar options for increasing pearl millet productivity in arid regions. Indian J Fund Appl Life Sci. 2011;1(2):200-208.
10. Timsina J. Can organic sources of nutrients increase crop yields to meet global food demand? Agron. 2018;8(10):214. https://doi.org/10.3390/agronomy8100214.