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Effect of amendments and micronutrients on chlorophyll content and yield of pearl millet grown on calcareous soil

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Abstract
Field experiment was conducted during the year 2015-16 at Micronutrient Research Project Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was laid out in randomized block design with three replications and eight treatments, which comprised of only GRDN (50:25:25 kg ha-1 N: P2O5: K2O + 5 t ha-1 FYM), GRDN with Gypsum, elemental sulphur, PMC-compost, PBSW, fermented cow dung slurry, Micro (Grade-I) with fermented cow dung slurry and Micronutrients with fermented cow dung slurry. In general, it is concluded that application of GRDN + Post bio methanated spent wash @ 80 m3ha-1 or PMC-compost @ 5 t ha-1 as a amendments one month before sowing of pearl millet and general recommended dose of nutrient (50:25:25 kg ha-1 N: P2O5: K2O + 5 t ha-1 FYM) to pearl millet at sowing was found beneficial for increase in grain and stover yield.

Keywords: Amendments, micronutrients, calcareous soil

Introduction
Calcareous soils are frequently characterized by their low bioavailability of plant nutrients due to high base status and pH between 7.5 and 8.5 and the presences of carbonate minerals (Marschner, 1995) [4]. In neutral to calcareous soils the excess of lime produces adverse effects, not by virtue of any marked toxic action of lime it self, but because of alkalinity it imparts to soil, its buffering effects decreases availability of phosphorus, potassium, iron, manganese, boron and zinc (Chapman, 1966) [1]. In order to suppress the impact of biological oxygen demand (BOD), biomethanation process is recommended wherein the raw spent wash is subjected to anaerobic decomposition process thereby the biological oxygen demand (BOD) level is brought down to 85 per cent (Rajkishore, 2008) [5] which is popularly referred as Post Methanated Distillery Spentwash (PMDSW). This waste water is considered safer to use for crop production as a source of nutrients (Davamani, 2002) [2].

Material and Methods
The present investigation was carried out at Micronutrient Research Project, Research Farm, (Survey No. 66/ 2) of Department of Soil Science and Agricultural Chemistry, Mahatma Phule Krishi Vidyapeeth Rahuri during 2015-16. The experiment was laid out in a randomized block design with 8 treatments and 3 replications. The gross plot size was 4.5 m x 3.0 m and net plot size was 2.40 m x 3.90 m. The amendments like PMC-compost (@ 5 t ha-1), PBSW (80 m3ha-1), elemental sulphur (1 t ha-1), Gypsum (5 t ha-1) were mixed with FYM and applied treatment wise in soil one month before sowing of pearl millet and micronutrients Grade-I (10 kg ha-1), FeSO4.7H2O (25 kg ha-1), ZnSO4.7H2O (20 kg ha-1), Borax (5 kg ha-1) were applied with fermented cow dung slurry at 30 DAS with irrigation water as per treatment. The soil analysis was done with help of Soil Chemical Analysis by (Jackson, M.L. 1973) [3]

Results and Discussion
Effect of amendments and micronutrients on chlorophyll content in pearl millet at 45 and 55 days after sowing
The data in respect of chlorophyll content in pearl millet fresh leaves at 45 and 55 DAS as influenced by different amendments and micronutrients on calcareous soil are presented in table - 1 which indicated that the highest significant increased in chlorophyll content (0.96 mg

g-1 fr. wt.) was observed in treatment of T5 (GRDN + PBSW) over all the treatments at 45 DAS. However, no significant difference was observed in total chlorophyll content in pearl millet leaves at 55 DAS. The increased in chlorophyll content in leaves of pearl millet at 45 DAS might be due to role of iron in chlorophyll synthesis and zinc for chlorophyll production, which were supplemented through PBSW and slight reduction of pH due to application of PBSW

Effect of amendments and micronutrients on grain and stover yield of pearl millet

The data of grain and stover yield of pearl millet as influenced by application of different amendments and micronutrients on calcareous soils are given in table – 2.

The highest significant grain yield of pearl millet was obtained (20.52 q ha-1) in treatment of T5 (GRDN + PBSW) over all the treatments under study except 20.30 q ha-1 In treatment of T4 (GRDN + PMC-compost). Due to delayed rainfall and dry spell during crop growth period (unfavourabe climatic condition) the pearl millet grain yield was lower down. Rajkishore (2008) [5] also reported that one time controlled application of spentwash @ 80 m3 ha-1 increased yield of rainfed black gram.

The significant increased in stover yield of pearl millet (33.21 q ha-1) was obtained in treatment of T5 (GRDN + PBSW) over all treatments except 32.79 q ha-1 in treatment of T4 (GRDN + PMC-compost). The increase in grain and stover yield of pearl millet due to application of PBSW and PMC-compost might be due to increased in soluble salts and slight decreased in soil pH in the rhizosphere of calcareous soil in which most of the nutrients may be available and supplemented through PBSW and PMC-compost.

The post biomethanated spent wash contain 1.03 per cent total K which increased availability of K in soil. Pearl millet is known for higher K uptake among the cereals. This phenomenon might have responded for higher N and P uptake and significantly increased the grain and stover yield.

Table 1: Effect of amendments and micronutrients on total chlorophyll content in pearl millet fresh leaves on calcareous soil

Sr. No.	Treatment	Total chlorophyll content (mg g-1) of fresh leaves	
		45 DAS	55 DAS
1	GRDN (50:25:25 kg ha-1 N: P2O5:K2O + 5 t ha-1 FYM)	0.71	1.42
2	GRDN + Gypsum @ 5 t ha-1	0.62	1.43
3	GRDN + Elemental Sulphur @ 1 t ha-1	0.59	1.40
4	GRDN + PMC compost @ 5 t ha-1	0.82	1.40
5	GRDN + Post biomethanated spent wash @ 80 m3 ha-1	0.96	1.47
6	GRDN + Fermented cow dung slurry (cds) (1:4) @ 500 L ha-1	0.82	1.43
7	GRDN + Micro (Grade I) @ 10 kg ha-1 + fermented cow dung slurry (cds) (1:4) @ 500 L ha-1	0.70	1.45
8	GRDN + FeSO4 @ 25 kg ha-1 + ZnSO4 @ 20 kg ha-1 + Borax @ 5 kg ha-1 + fermented cow dung slurry (cds) (1:4) @ 500 L ha-1	0.78	1.44
	S.E. +	0.037	0.041
	CD at 5 %	0.114	N.S.

Table 2: Effect of different amendments and micronutrient on grain and stover yield of pearl millet

Sr. No.	Treatment	Grain yield (q ha-1)	Stover yield (q ha-1)
1	GRDN (50:25:25 kg ha-1 N: P2O5:K2O + 5 t ha-1 FYM)	14.67	23.73
2	GRDN + Gypsum @ 5 t ha-1	15.60	25.10
3	GRDN + Elemental Sulphur @ 1 t ha-1	15.75	24.45
4	GRDN + PMC compost @ 5 t ha-1	20.30	32.79
5	GRDN + Post biomethanated spent wash @ 80 m3 ha-1	20.52	33.21
6	GRDN + Fermented cow dung slurry (cds) (1:4) @ 500 L ha-1	16.09	26.04
7	GRDN + Micro (Grade I) @ 10 kg ha-1 + fermented cow dung slurry (cds) (1:4) @ 500 L ha-1	17.04	27.36
8	GRDN + FeSO4 @ 25 kg ha-1 + ZnSO4 @ 20 kg ha-1 + Borax @ 5 kg ha-1 + fermented cow dung slurry (cds) (1:4) @ 500 L ha-1	16.36	24.92
	S.E. +	0.62	1.04
	CD at 5 %	1.90	3.15

Conclusion

From the present study, it is concluded that application of post biomethanated spent wash @ 80 m3 ha-1 or PMC-compost @ 5 t ha-1 as amendments one month before sowing of pearl millet and general recommended dose of nutrient (50:25:25 kg ha-1 N: P2O5: K2O + 5 t ha-1 FYM) to pearl millet at sowing was found beneficial for increase in grain and stover yield of highly calcareous soil.

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