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Influence on different sources of liming materials on cob characteristics of maize grown in acid soil of Odisha

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Abstract
A field experiment was conducted to study the "Influence of different sources of liming materials on cob characteristics of maize grown in acid soil of Odisha" in the village Bajpur of Khorda district during kharif, 2013. The soil was ameliorated with three different sources of liming materials i.e paper mill sludge, stromatolyte & calcium silicate added with soil test based recommended dose with or without FYM. The application of liming materials alone increases the cob length, diameter & seed/cob up to 17.1 cm, 13.6 cm & 68.7g respectively where was the combine application of liming materials with organic manure increases the cob length, diameter & seed/cob more i.e 17.6 cm, 13.9 cm & 75.4g respectively. The application of paper mill sludge mixed with soil test based recommended dose & FYM is the best treatment which gives the higher cob length, diameter & seed/cob i.e 17.6 cm, 13.9 cm & 75.4g respectively. The double dose of stromatolyte gives the higher cob length, diameter & seed/cob compare to the application of single dose of stromatolyte in both alone and mixed with FYM. There was very short cob length (11.0 cm), diameter (10.2 cm) & very less seeds/cob (22.8 g) was seen in the absolute control compare to the all the treatments.

Keywords: Acid soil, paper mill sludge, stromatolyte, calcium silicate, cob length, cob diameter & seeds/cob

Introduction
Soil acidity is a major constraint for crop production in tropics, due to low soil pH and poor availability of plant nutrients, such as phosphorus (P), calcium (Ca), magnesium (Mg) and potassium (K). It leads to poor soil biological activity, hindering organic matter mineralization and therefore, nitrogen availability (Baligar and Fageria, 1997; Kamprath, 1984) [2, 8]. The acidity is attributed to their development from acid parent materials, high rainfall, leading to leaching of bases and in some cases, application of acid forming fertilizers (Jaetzold and Schmidt, 1983; Kanyanjua *et al*., 2002) [7, 9]. Amelioration of acid soil by different liming materials can raise soil pH, benefiting soil properties and plant growth and liming is widely practiced for improving the acid soils productivity (Adams, 1984; Edmeades and Ridley, 2003; Conyers, 2006) [1, 5, 4]. There are plenty of liming materials that can be used to neutralize soil acidity, but majority of them comes from ground limestone such as calcite (CaCO3) and dolomite (CaCO3, MgCO3). Acid soils are usually excessive in soluble Al and Mn and deficient in P, Ca, Mg and Mo, that may cause their reduced uptake and lead to nutrient imbalances in plants (Foy, 1984; Clark and Baligar, 2000) [6, 3]. Maize is not only important for humans but also being consumed as feed materials for poultry and pigs. Maize is mainly cultivated during Kharif season in the state and the crop is sown from the month of March to June depending upon the selection of variety. The productivity of maize is low as compared to the national productivity of 2000 kg/ ha. Spectacular increase in maize yield has been reported by several workers with lime addition. Maize responds positively with lime addition in an acid soil and under this backdrop of information the present investigation was taken. The present study aimed to investigate the Influence of different sources of liming materials on cob characteristics of maize grown in acid soil of Odisha.

Materials & Methods
In this experiment there was three different sources of liming materials were used. These three sources are paper mill sludge (PMS), stromatolyte (ST) & calcium silicate (CS).

Liming materials were applied with or without FYM. There was ten treatments were under taken which were replicated three times. The soil test based recommended dose was common in all the treatments except absolute control. The maize cob samples were collected from all the treatment plots after harvesting. These samples were dried. Then the length & diameter was calculated treatment wise. The seeds were removed from the cob by maize seller. These seeds were weighed and calculated the seeds/cob.

Result & Discussion

The influence of the different sources of the liming materials on cob length, diameter and seed/cob were presented in the Table-1.

Table 1: Influence of different sources of liming materials on cob length, diameter and seed/cob

Treatments	Cob length (cm)	Cob diameter (cm)	Seeds/Cob (g/Cob)
Absolute Control	11.0	10.2	22.8
STD	15.2	12.4	54.7
STD + PMS @ 0.1 LR	17.1	13.6	66.0
STD + PMS @ 0.1 LR + FYM	17.6	13.9	75.4
STD + ST @ 0.1 LR	16.2	13.5	60.4
STD + ST @ 0.1 LR + FYM	16.6	13.6	66.0
STD + ST @ 0.2 LR	16.5	13.6	68.7
STD + ST @ 0.2 LR + FYM	16.9	13.9	74.9
STD + CS @ 0.2 LR	15.8	13.0	68.0
STD + CS @ 0.2 LR + FYM	16.4	13.8	74.0

The length of the cob was influenced by different sources of liming materials which was varied between 11.0 cm and 17.6 cm. The lowest cob length was seen in absolute control (11.0 cm) where was highest was seen in soil test based recommended dose mixed with PMS@0.1 LR and FYM (17.6 cm). The application of PMS @ 0.1 LR alone increases the cob length up to 17.1 cm but integrated use of PMS @ 0.1 LR with organic manure increases the cob length up to 17.6 cm. The application of ST @ 0.1 LR alone increases the cob length up to 16.2 cm but the integrated use of ST @ 0.1 LR with organic manure increases the cob length up to 16.6 cm. The double dose of ST @ 0.2 LR alone increases the cob length up to 16.5 cm but the integrated application of ST @ 0.2 LR with organic manure increases the cob length up to 16.9 cm. The application of CS @ 0.2 LR alone increases the cob length up to 15.8 cm but the integrated application of CS @ 0.2 LR with organic manure increases the cob length up to 16.4 cm. (Table-1, Figure-1)

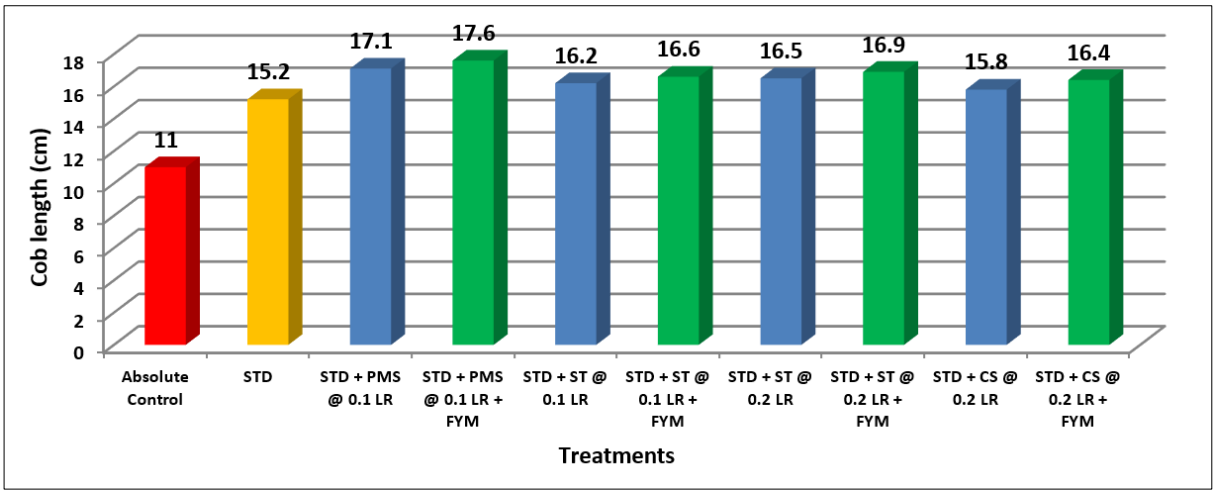

Fig 1: Influence of different sources of liming materials on cob length

The diameter of the cob was influenced by different sources of liming materials which was varied between 10.2 cm and 13.9 cm. The lowest cob diameter was seen in absolute control (10.2 cm) where was highest was seen in soil test based recommended dose mixed with PMS@0.1 LR and FYM (13.9 cm). The application of PMS @ 0.1 LR alone increases the cob diameter up to 13.6 cm but integrated use of PMS @ 0.1 LR with organic manure increases the cob diameter up to 13.9 cm. The application of ST @ 0.1 LR alone increases the cob diameter up to 13.5 cm but the integrated use of ST @ 0.1 LR with organic manure increases the cob diameter up to 13.6 cm. The double dose of ST @ 0.2 LR alone increases the cob diameter up to 13.6 cm but the integrated application of ST @ 0.2 LR with organic manure increases the cob diameter up to 13.9 cm. The application of CS @ 0.2 LR alone increases the cob diameter up to 13.0 cm but the integrated application of CS @ 0.2 LR with organic manure increases the cob length up to 13.8 cm. (Table-1, Figure-2)

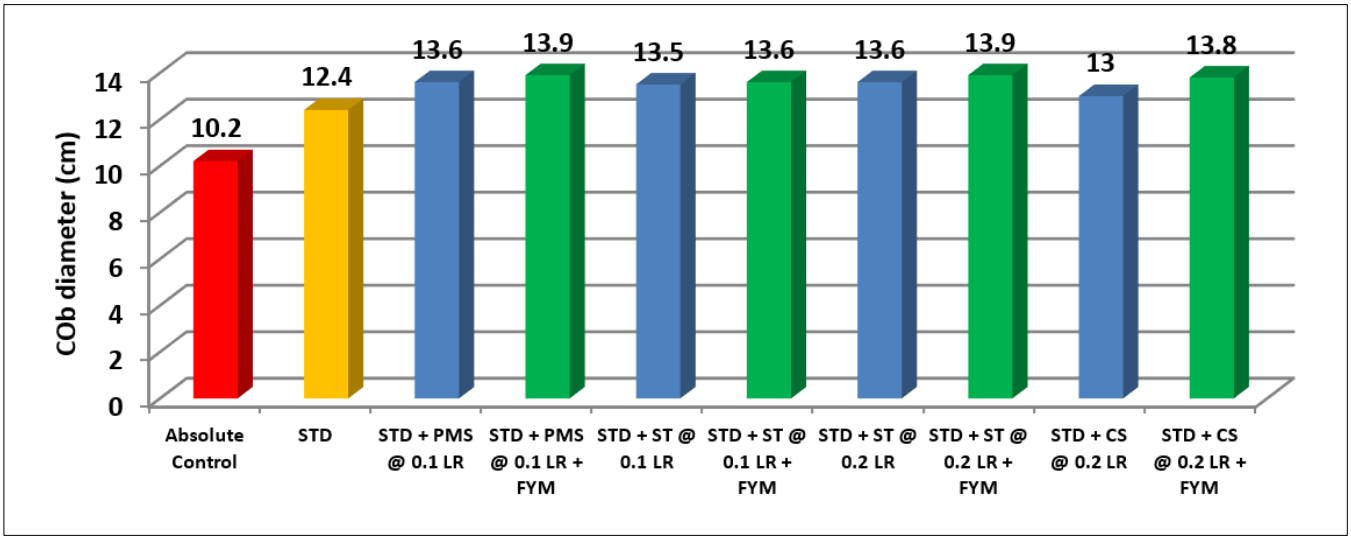

Fig 2: Influence of different sources of liming materials on cob diameter

The seeds/cob was influenced by different sources of liming materials which was varied between 22.8g and 75.4g. The lowest seeds/cob was seen in absolute control (22.8g) where was highest was seen in soil test based recommended dose mixed with PMS@0.1 LR and FYM (75.4g). The application of PMS @ 0.1 LR alone increases the seeds/cob up to 66.0g but integrated use of PMS @ 0.1 LR with organic manure increases the seeds/cob up to 75.4g. The application of ST @ 0.1 LR alone increases the seeds/cob up to 60.4g but the integrated use of ST @ 0.1 LR with organic manure increases the seeds/cob up to 66.0g. The double dose of ST @ 0.2 LR alone increases the seeds/cob up to 68.7g but the integrated application of ST @ 0.2 LR with organic manure increases the seeds/cob up to 74.9g. The application of CS @ 0.2 LR alone increases the seeds/cob up to 68.0g but the integrated application of CS @ 0.2 LR with organic manure increases the seeds/cob up to 74.0g. (Table-3, Figure-3)

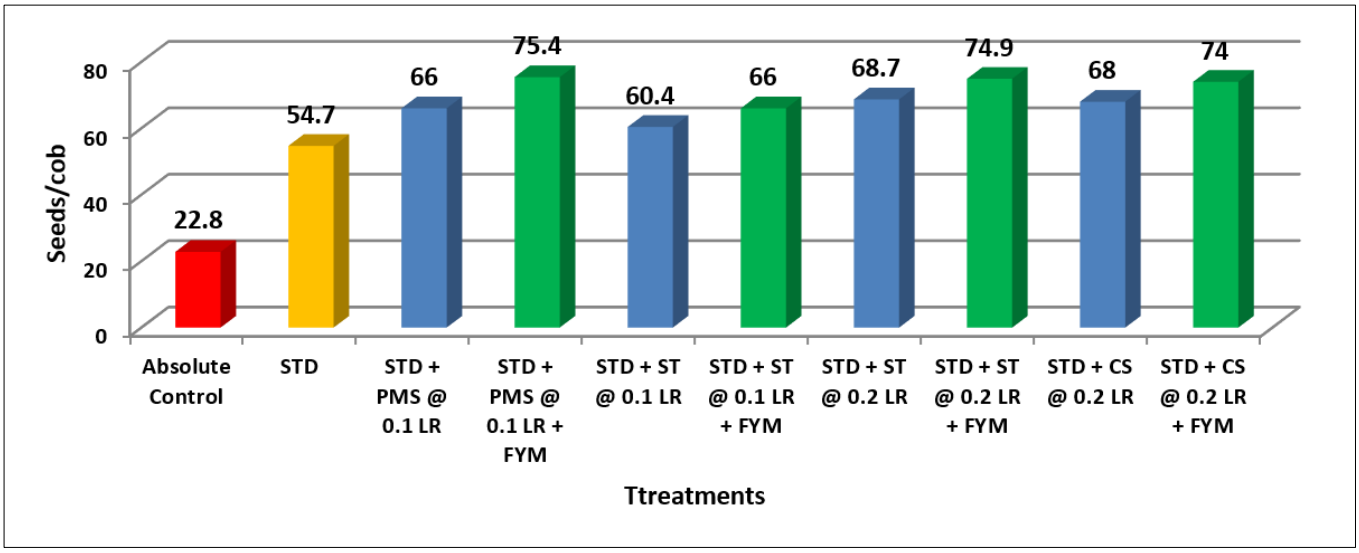

Fig 3: Influence of different sources of liming materials on seeds/cob

Conclusion

The application of liming materials alone increases the cob length, diameter & seed/cob up to 17.1 cm, 13.6 cm & 68.7g respectively where was the combine application of liming materials with organic manure increases the cob length, diameter & seed/cob more i.e 17.6 cm, 13.9 cm & 75.4g respectively. The application of paper mill sludge mixed with soil test based recommended dose & FYM is the best treatment which gives the higher cob length, diameter & seed/cob i.e 17.6 cm, 13.9 cm & 75.4g respectively. The double dose of stromatolyte gives the higher cob length, diameter & seed/cob compare to the application of single dose of stromatolyte in both alone and mixed with FYM. There was very short cob length (11.0 cm), diameter (10.2 cm) & very less seeds/cob (22.8 g) was seen in the absolute control compare to the all the treatments.

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