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Impact of Bio-Fertilizer and Gypsum on Growth, Yield and Quality of Sugar Cane

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Abstract
Sugar cane is mostly sown in loamy soil that provides absolute situation which enhance the root development and reduce the extent of the next crop .The importance of our study was to show the utilization of gypsum , BOP 20% Phosphorus and 25% organic matter used on root development and their impacts on the cane yield and quality of sugar cane as compared to inorganic fertilizers. Application of gypsum and bio fertilizer increase the sugar recovery about 0.2 to 0.4 . Three level of gypsum mixed into the soil 150kg,300kg 500 kg and BOP apply 100 kg per acre into rows and standard NPk, and noted in T4 that max growth percentage 75.38%, and more stem girth inches 3.57 and brix was seen 16.71 ultimately more production up to 56 ton / ha of sugar cane while in control plot growth percentage was 39.38% , normal stem girth was seen1.83 inches and brix was seen 10.71 , less production 21.03 ton /ha . Bio fertilizer increase the soil texture by improving overall standard (Tate 1987), That will increase the moisture retention in the soil as well as exchange of gases . Therefore bio fertilizer have great importance to decrease the soil borne disease (Hointtink and Fahay 1986) As to increase the structure and absorption ability of fertilizer (Duluca and Deluca 1987). Suggests that gypsum and BOP rate in our study, gypsum apply and BOP apply into rows is the preferred practices for sugar cane cultivation on alkali soil.

Keywords: Sugarcane , gypsum ,bop, yield , quality

Introduction

Sugar cane is more profitable crop in Pakistan .In the year 2012 -13 -2022-23 , yield in Pakistan enhance @3.1 % per annum, normally increased in production 2.3% sugar cane crop @0.8%. Sugar cane yield in sindh is improved 0.3% per annum, 1.7% per annum in KPK , therefore more 4.4% in Punjab and 2.6% per annum in Baluchistan .

Over all provincial of Agriculture Department crop reporting service. Sugar cane yield at national in 2022-to 2023 sugar cane is 87.981 million ton less in 0.8 % in the previous year yield was 88.650 million ton low in yield 5.2 % decrease in production ,therefore sugar cane crop enhance @4.6% . Main reason is to climate fluctuation and flood 2022 in sindh . Expenses are more valuable to identify the rate of sugar cane. Expenses are more in the year 2023-2024 are more about 12% in Punjab ,14.6 5 in sindh 125 in KPK in the 2022-2023 . Expenses are increased in all over Pakistan and all others expenses are also more such as land lease, more expenses seed striping, binding, loading operation (Analysis 2023-2024) . Sugar cane production is 1.71 billion tones in 2008 1.87 billion ton in 2020 about sowing is 26 billion ha the FAO (FAOSTAT 2022a). Sugar cane Production is more in brazil ,India and Pakistan where as decrease in china (FAOSTAT ,2022b).Estimated that sugar cane cultivation decrease in the world 2023 /2024 more cost in sugar cane because high price of inorganic fertilizer (European commission 2023a) . As more demand in the market grower have high demand of cash in the world, Europe and north America (Bonsucro 2021 ;(FAOSTAT2023)

Sugar cane is cultivated in loamy soil that is not standard for the development and process of the root system. Sugar cane is three years of old raton crop one year crop is plant crop. Due to various facts to damage ratoon crop (carter1977).

Apply gypsum mix into the soil that enhance the texture of loamy soil and water have enable to enter into the soil which increased the sugar cane growth due to addition of ca into the soil (Mohandus et al 1983).

Sulfur is one of the 16 elements essential to crop production, and it is essential for maximum crop yield and quality, often ranked behind only nitrogen, phosphorus and potassium in importance (Jeschke and Diedrick, 2010).

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Sulfur is one of the 16 elements essential to crop production, and it is essential for maximum crop yield and quality, often ranked behind only nitrogen, phosphorus and potassium in importance (Jeschke and Diedrick, 2010)Compost enhance the production as well as increase soil fertility and sugar cane cultivated for many years (Hallmark etmall 1995)Production enhance by the application of compost (Bevacqua and Mellano,1994 ,Roe et al1997),bio fertilizer have no drawbacks on the crop production . Similarly gypsum and bio fertilizer have great role in the fertility of soil and sugar cane disease , ultimately enhance yield of sugar cane (Breithaupt et al 1991). Gypsum is more important to decrease soil borne disease in many crops (Kao and ko ,1986) However 11.2 and 22.4 M g ha gypsum is use for loamy soil to enhanced the yield of two year old sugar cane crop (Breithaupt et al 1991Sulfur is very important after nitrogen phosphorus potassium to increase yield and quality of sugar cane (jeschk and diedrick 2010). Sulfur remain deficient in the past for getting more yield need more sulfur , absence of sulfur decrease the environmental as well as deficient of organic matter (AW, PW and JH, 2005; Ceccotti, 1996).

Bio fertilizer increase the soil texture by improving overall standard (Tate 1987), That will increase the moisture retention in the soil as well as exchange of gases . Therefore bio fertilizer have great importance to decrease the soil borne disease (Hointtink and Fahay 1986) As to increase the structure and absorption ability of fertilizer (Duluca and Deluca 1987).

Agricultural or mineral gypsum (CaSO4 .2H2O) is being widely used as source of nutrients such as calcium and sulfur and to adjust aluminum toxicity in the deeper soil layers (Caires et al., 2006; Nora and Amado, 2013).

Due to higher amount of PH in favor of gypsum given in 40- 60 cm above the soil surface to determine in cacl2. More pH in subsoil taken response by applying gypsum is attached to the movement of hydroxyl (OH-) from upper surface of iron and aluminum and hydroxides by sulfate ions (SO4-2), when separate from (ca2+) (Reeve and summer 1972; caires at el.,2006).

Bio fertilizer is very important for roots, shoot of crop as well as the mixture of organic matter (Murillo et al 1999). Bio fertilizer also the source of these elements that is NpK and ca as the small nutrients Cu ,Fe, Mn and Zn , these elements maintain the pH of soil (Stamatiadis et al;1999). However it must be noted that the addition of small nutrients in the plants there may be applying of bio fertilizer then it become a source of acidity and decrease quality as well as production of crop (Rengel et al 1999).

Bio fertilizer create resistivity against many disease that is pythium root rot and Rhizoctinia root rot (Zhang et al 1996 , Dissanayake and Hoy 1999).

Sulfur occurred in the crop from 0.2-0.5%. Sulfur is noted after investigate the crop. Amount of sulfur in the crop cell generally help to check the sulfur deficiency and the amount of sulfur can be calculated by leaves analysis (Randall et al., 1997; Shrift, 1961).

Sugar cane production by using sulfur more production as well as increase CSS production Gangwar and Parameswaran (1977) and Sagare et al. (1990) in sunflower, Singh and Bairathi (1980) in mustard, Das and Das (1994).

Material and Method

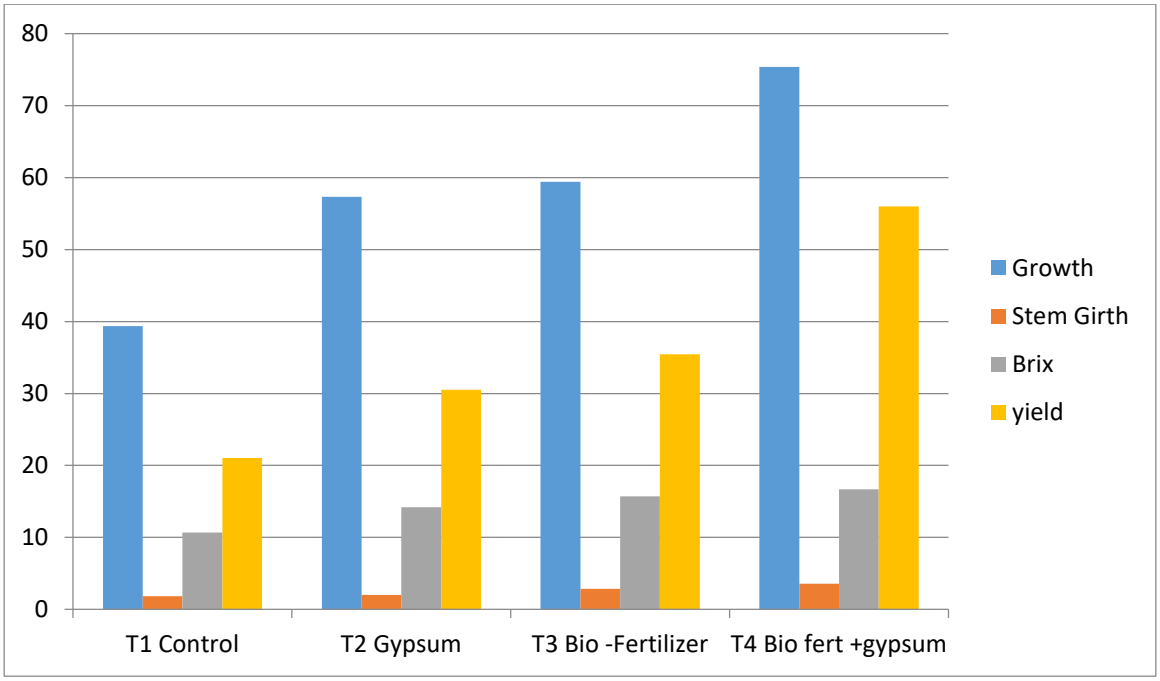
The study was conducted on an area of 1.944 ha ,in which sugar cane variety cp 77/400 was calculated .Four treatments ,T1(control) T2 (sulfur application), T3 (Bio fertilizer) and T4 (sulfur + bio fertilizer) were take under randomize complete block design (RCBD) with three replication. As time of land preparation, there levels of gypsum 150 kg, 300 kg, 500 kg. Recommended dose of NPK fertilizer along with micro nutrients (ca Mg and Zn) were applied to all treatments two pack of fipronil , 6 kg zink plus 7% and recommended dose of fertilizer NPK were applied at the time of sugar cane cultivation . Lightly covered sets with soil and irrigate the soil. After complete germination apply organic matter (Humic acid 12%, potash 6% , fulvic acid 2%) three different levels of gypsum 150 kg ,300 kg 500 kg were applied . Data was noted on various condition of sugar cane growth, stem girth cane yield and brix.

Table 1: Influence on Grand Mean=cv of bio fertilizer and gypsum on the growth, Stem girth, yield, and quality of sugar cane .

Treatments gypsum	Growth	Stem girth	Brix	Yield
T1	Grand Mean 39.38 Cv 16	Grand Mean 1.83 Cv 32.42	Grand Mean 10.71 Cv 24.22	Grand Mean 21.03 Cv 12.69
T2	Grand Mean 57 .33 Cv 10.85	Grand Mean 2.03 Cv13.26	Grand Mean 14.26 Cv 12.14	Grand Mean 30.52 Cv18.25
T3	Grand Mean 59.44	Mean 2.84 Cv 10.86	Grand Mean 15.7 Cv 11.93	Grand Mean 35.47

	7.96			Cv 12.69
T4	Grand Mean 75.38 Cv 9.92	Grand Mean 3.57 Cv 8.11	Grand Mean 16.71 Cv 15.85	Grand Mean 56 Cv 120.46

Fig 1: Influence of bio fertilizer and gypsum on the growth, Stem girth, yield, and quality of sugar cane .



Results and Discussion

Sugar cane is very long crop need more nutrients as well as water. After harvesting of sugar cane sulfur is deplete in large amount from the soil .The use of bio fertilizer and gypsum is very cheap and decrease fertilizer wastage. Bio fertilizer and gypsum enhance the fertilizer use efficiency. Farmer mostly use huge amount of inorganic fertilizer and utilization of fertilizer is very less. (Ali, 1986 ; Humbert, 1968), reported that sugar cane use more nutrients and exhaust higher amount of sulfur from the land . 100 ton of sugar cane plants exists 47.6 kg SO4. However Use of sulfur create more availability of all elements to crop like nitrogen ,phosphorus and potash need in sugar crop about 90kg s/ha .Many resource of gypsum test contain more availability of elements and considerable amount of sulfur present in gypsum. The utilization of urea is more efficient with sulfur collectively to enhance the production. To increase movement of land phosphorus availability by using sulfur resulted to reduction in ph and maximum usage by the plants (Raikhy et al 1985) and Tiwari et al ; 1984). The research was organized to describe the impact of bio fertilizer and gypsum to increase growth yield and quality of sugar cane. Treatments are as fallows.

In the treatment T1 growth was minimum and maximum is noted. Minimum 39.38% growth was seen in the research while maximum growth was noted 75% . **Lee (1926)** say that 65% sugar cane roots media were occur about 20 cm depth from the upper surface of soil .It is observe that roots and soil structure increase by the use of gypsum . (Ritchey et al 1982)

reported that the effect of minimums growth due to Less rain duration create several aluminum acidity and less calcium in the lower surface of land.

Similarly stem girth were noted minimum and maximum in the treatment T1 minimum stem girth was seen 1.83 inches and maximum stem girth was observe more 3.57 inches in T4 treatments.

Costa et al. 2011), reported that enhanced stem girth due to get more development in the sugar cane crop . (Murillo et al 1999) ,study shows that importance and standard of bio fertilizer for roots , shoot of crop as well as the mixture of organic matter.

Brix was low and high was noted during the study. Low brix was seen in the T1 1 0.71 while max brix was observed 16.71 because more amount of gypsum is used. (ceccot 1996) , study that Sulfur have a great role in the crop metabolism, need for amino acid , protein and photosynthesis. Sulfur deficient suddenly stop the development of the crop yellowing of leaf occurred. Sulfur deficiency generally may not be seen and sugarcane production as well recovery will decrease .(Gangwar and Parameswaran 1977), shows that Take up of potassium by the crop to enhance sugar cane production by using sulfur more production as well as increase css production . (jeschk and diedrick 2010) Noted that Sulfur is very important after nitrogen phosphorus potassium to increase yield and quality of sugar cane.

Yield was noted in the T1 21.03 ton/ha **Costa et al. (2011)**, observed that less in shoot plants reason is that more competition of water ,sunlight and fertilizer damaging and less emerge out of shoot plants per tillers from the main shoot. It explained that less gypsum and no use of bio fertilizer decrease the tiller capacity of the plants (AW, PW and JH, 2005; Ceccotti, 1996), study shows that Sulfur remain deficient in the past for getting more yield need more sulfur , in the absence of sulfur decrease the environmental as well as deficient of organic matter (ceccot 1996) , results shows that Sulfur have a great role in the crop metabolism, need for amino acid , protein and photosynthesis. Sulfur deficient suddenly stop the development of the crop yellowing of leaf occurred. While in the T4 56 ton /ha was seen after harvesting of sugar cane crop. (jeschk and diedrick 2010), noted that Sulfur is very important after nitrogen phosphorus potassium to increase yield and quality of sugar cane . (Caires et al., 2006; Nora and Amado, 2013), reported that Agricultural or mineral gypsum (CaSO4 .2H2O) is being widely used as source of nutrients such as calcium and sulfur and to adjust aluminum toxicity in the deeper soil layers (Hallmark et all 1995), explained that Compost enhance the production as well as increase soil fertility and sugar cane cultivated for many years. (Bevacqua and Mellano,1994 ,Roe et al 1997), say that Production enhance by application of compost bio fertilizer have no drawback on the crop production. (Breithaupt et al 1991), research shows that gypsum and bio fertilizer have a great role in the fertility of soil and sugar cane disease ,ultimately enhance the yield of sugar cane . (Dissanayake and Hoy 1999) As the crop disease Zhang et al 1996 shows that bio fertilizer create resistivity against many disease that is pythium root rot and Rhizoctinia root rot. (AW, PW and JH, 2005; Ceccotti, 1996),sulfur remain deficient in the past for getting more yield need more sulfur in the absence of sulfur decrease the environmental sulfur as well as deficient of organic matter.

(Gangwar and Parameswaran (1977), explained that take up of potassium by the crop to enhance sugar cane production by using sulfur more production as well as increase css production .

(Caires et al., 2006); Nora and Amado, 2013) reported that under these conditions, root growth is restricted and thus limiting the access to water and nutrients available in the soil profile

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Conclusion

Uptake of bio fertilizer from the root is more in sugar cane crop. Gypsum is more economical in use than the sulfur. Gypsum role is to improve soil structure clean all the hazards elements in the soil and convert into available form to roots of plants .Bio fertilizer enhance the fertilizers use efficiency. Hence it is concluded that 500 kg gypsum and 100 kg bio fertilizer is recommended for getting profitable production of sugar cane as well as more absorption of nutrients by the roots of plants.

Suggestion:

10 bags of gypsum and two bags of bio fertilizer is used for maintaining soil fertility for a long period of time and increase production as well as increase the quality of sugar cane.

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