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# MORPHOLOGICAL RESPONSE OF SUGARCANE VARIETY Co 1001 TO CHEMICAL PRETREATMENTS

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**ABSTRACT**
In order to establish the possible influence(s) of chemical pretreatments on morphological changes in sugarcane seedlings during growth, lime (CaO) was applied as a pretreatment. Seed canes were soaked in 1%, 2% and 5% calcium oxide solutions for one hour before they were planted in 10 litre plastic buckets filled with steam-sterilized soils. Other treatments involved soaking in distilled water and no soaking as the control. Optimum cane germination was obtained for seedcanes soaked in 2% and 5% CaO and no soaking treatments. Least number of days to first bud emergence was obtained when seedcanes were planted fresh without soaking. Lime pretreatment had positive effect on emergence rate and yield components possibly due to the cation's stimulation of enzymes release for growth promotion and metabolism in sugarcane seedlings. The act of soaking before planting could stimulate hydrolytic effect as well as leach-off the growth inhibitors in the cane seedlings thus encouraging growth and yield.

**KEY WORDS:** Pretreatments, soaking, bud emergence.

## INTRODUCTION

Sugarcane (*Saccharum officinarum L.*) is the major source of raw material for the production of refined sugar in Nigeria. Various efforts directed at improving cane yields in Nigeria had been through fertilization, pests and diseases control and improved cultural practices (Anon 1992: Agbana, 1991; Afolabi, 1999).

Pretreatments had hitherto been used in developing countries for improving the germination and development of seedcanes (Murkeji, 1979; Chen *et al*, 1981, Yang & Chen, 1980). A study in Taiwan on the germination response of seedcanes to soaking and exposure treatments showed that magnesium sulphate used as pretreatment enhanced seedcane germination (Chen *et al,* 1981). The reports of Lo & Yang (1981) also showed that when seedcanes were exposed to more than a day of soaking in water, it resulted in enhanced cane bud emergence and development.

Many investigators had also conducted extensive experiments to determine the effect of chemicals on growth, yield and juice quality of sugarcanes (Davidson, 1965: Sun, 1984. Chen *et al*, 1986 Lui *et al*, 1984 and Chang, 1984). There had however been limited information on the use of chemicals as pretreatment for sugarcane production in Nigeria. The present work describes the use of lime as pretreatment in sugarcane production and determines its effect on bud emergence, growth and development of sugarcane.

## MATERIALS AND METHODS

The experiment was carried out in the screen house of the University Sugar Research Institute in Faculty of Agriculture, University of Ilorin, Nigeria.

Three single-eyed nodes pieces of sugarcane variety Co 1001 presently a standard commercial variety in Nigeria, were planted in each plastic bucket. The seedcanes were soaked in 1%, 2% and 5% Calcium Oxide (CaO) solution for one hour. The seed canes soaked in distilled water for one hour constituted another treatment, while seed canes planted fresh with no soaking served as control. These five treatments had four replications. The platic buckets were arranged in a completely randomized design and watered regularly after planting until maturity. The plants were fertilized using NPK 15:15:14 compound fertiliser at standard rate of 125 $KgNha^{-1}$, 60 $KgOha^{-1}$ and 60 $KgP_2O_5ha^{-1}$ (Anon. 1990) at four weeks after planting to uniformly boost cane growth.

Sprouting were observed and recorded from the buckets beginning from four days after planting. The percentage germination was calculated (as the number of sprouts from each bucket over total of buds planted). The seedlings were thinned to one plant per bucket for good seedling establishment and the number of days to bud emergence was recorded. The cane plant heights were measured at 10, 12, 14 and 16 weeks after planting (WAP). The numbers of leaves per pot were estimated at 4. 8, 12 and 16 WAP. The cane plants were harvested from individual pots and weighed (for yield determination) at 20 WAP.

## RESULTS AND DISCUSSION

Results obtained from the above observations were subjected to statistical analysis (Steel & Torrie, 1980) and presented in Tables 1 and 2 (Appendix 1).

Based on the results generated, percent (%) germination increased significantly with increase in lime concentrations. Although the highest percent germination was obtained at 5% CaO, this was not significantly better than at 2% CaO and no soaking treatments (Table I).

**TABLE 1.** The effect of lime on the number of cane leaves, percent germination and number of days to first emerged bud

| Treatments | Number of leaves | | | | Germination (%) | No of days to first emerged bud |
|---|---|---|---|---|---|---|
| | 4WAP | 8WAP | 12WAP | 16WAP | | |
| No soaking | 4[a] | 6[a] | 8[a] | 9[b] | 105[d] | 4[bc] |
| Distilled water | 4[a] | 4[c] | 4[d] | 7[c] | 50[c] | 4[bc] |
| 1% CaO | 4[a] | 5[b] | 5[c] | 10[b] | 75[b] | 6[a] |
| 2% CaO | 4[a] | 5[b] | 6[b] | 9[b] | 100[a] | 5[bab] |
| 5% CaO | 4[a] | 6[b] | 6[b] | 12[a] | 100[a] | 5[cab] |
| SE | 0.5 | 0.81 | 0.15 | 1.25 | 15.5 | 1.15 |

Means followed by the same letter(s) in a given column are not significantly different from each other by the DMRT (p= 0.05)
WAP = week after planting

**TABLE 2:** Effect of lime on the stalk length and cane yield

| Treatments | The internode length (cm) | | | | Cane yield (g) |
|---|---|---|---|---|---|
| | 4WAP | 8WAP | 12WAP | 16WAP | |
| No soaking | 12.0[c] | 18.0[a] | 32.0[a] | 53.0[a] | 94.4[b] |
| Distilled water | 10.1[c] | 14.9[b] | 5.5[c] | 35.9[c] | 83.6[c] |
| 1% CaO | 15.3[b] | 19.3[a] | 18.6[c] | 44.4[a] | 96.1[b] |
| 2% CaO | 14.2[b] | 21.9[a] | 23.3[b] | 60.0[a] | 94.7[b] |
| 5% CaO | 17.1[a] | 21.9[a] | 23.3[b] | 60.0[a] | 107.2[a] |
| SE | 0.85 | 1.50 | 0.98 | 1.78 | 5.40 |

Means followed by the same letter (s) in a given column are not significantly different from each other by the DMRT (p = 0.05).
WAP = weeks after planting.

The reports of Lo & Yang (1981) showed that soaking seedcanes in running or large volumes of water resulted in the leaching of growth and germination inhibitors, thus enhancing germination. Soaking of seed materials had earlier been reported as one effective way of promoting germination (Yang & Hsieh, 1977). The observations from this study were consistent with this report. Though a high germination percentage was obtained in seedcanes planted fresh, in commercial sugarcane production in Nigeria, it is seldom possible to accomplish the establishement of large acreages using fresh seed canes due to logistic reasons (Anon., 1990). It can be suggested that the positive effects of lime pretreatments on sugarcane would be a desirable agronomic practice in this agroecology. The lime pretreatments had significant effects on number of days to bud emergence. Seedcanes soaked in 1% CaO had significantly delayed bud emergence as compared to those soaked in 2% and 5% CaO. Although the faster bud emerged at no soaking and/or distilled water treatments, these were not statistically faster than emerged buds at 2% and 5% CaO treatments (Table 1).

There had been other reports that the act of soaking seed pieces in water or chemical solutions promoted bud emergence (Alexander, 1973 and Hsia, 1972). The reports of Yang & Hsieh (1977) again showed that the ability to germinate was closely related to the rate of inversion of sucrose in the sugar. They postulated that the higher the inversion rate, the quicker the germination. These mechanisms for promoting germination however seemed not consistent. One of the reasons postulated by another work alluded to the fact that more water was absorbed into the seed cuttings through soaking treatment (Chen *et al.* 1981) while the report of Hambert (1968) suggested that

enzymes in the seed cuttings were activated by the absorbed cat ions.

Lime (CaO) released $Ca^{2+}$, a co-factor for amylase activity that plays great roles in starch and sugar metabolism, as well as other biochemical changes during sugarcane development (Wong,1995). The observations in this study also support the findings. The delay in first emerged bud observed for seedcanes planted fresh with no soaking is consistent with the findings of Chen *et a*l. (1981) that fresh seed pieces took more days for all buds to emerge.

The effects of lime on mean stalk lengths of sugarcane at $4^{th}$, $8^{th}$, $12^{th}$ and 16th WAP (Table 2) showed that cane growth improved with age of the canes. Except for the $12^{th}$ week, the tallest stalk was obtained at 5% CaO although these were not statistically taller than stalks at no soaking treatment. The shortest mean stalk length was obtained in canes soaked in distilled water before planting at all periods of observation. Lui *et al*, (1984) had reported that seedcanes soaked in chemicals or water showed positive influence on cane growth. The findings in this study were also consistent with the report.

## CONCLUSION

The highest cane yield was obtained at 5% CaO, while the least was obtained at no soaking treatment. This was a possible indication of beneficial effects of the chemical pretreatments on yield; an important parameter for sucrose production. An evaluation of the effects of this chemical in the field is suggested for further study. Use of chemical as pretreatment could be a desirable agronomic practice in this agro ecology for boosting cane production.

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