Research article

Evaluation of Seed Cane Treatments on Sugarcane Germination in Two Planting Methods

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Abstract The experiments were conducted in the glasshouse of Sugarcane Research and Development Farm, Pyinmana to evaluate the effect of seed cane treatments on sugarcane germination of K-95/84 variety in two planting methods from August-October 2015 and June-August 2016. The glasshouse experiments were conducted in 2×4 factorial arrangement in Randomized Complete Block Design (RCB) with three replications. It evaluated two different planting methods (single budded setts and three budded setts) with pre-planting treatments by using different levels of lime (0, 7.5, 15, 22.5 g l^{-1}), different levels of topsin fungicide (0, 0.5, 1, 1.5 g l^{-1}) and different degree of hot water (0, 50, 52, 54˚C). Single budded setts gave the earliest and higher percentage of germination than three budded setts. Among the pre-planting treatments, the earliest and higher percentage of germination was obtained from the lowest level of lime 7.5 g l^{-1} (L_1), topsin fungicide 0.5 g l^{-1} (F_1) and hot water 50˚C (H_1) treatments. As a combined effect of two factors, single budded setts with lime 7.5 g l^{-1} (SL_1), topsin fungicide 0.5 g l^{-1} (SF_1) and single budded setts with hot water 50˚C (SH_1) gave maximum germination. Thus, this study highlighted that the single budded setts with lime 7.5 g l^{-1}, topsin fungicide 0.5 g l^{-1} and hot water 50˚C treatment should be used for the uniformity of germination.

Keywords sugarcane, planting method, pre-planting treatment, germination

INTRODUCTION

Sugarcane (*Saccharum* spp.) is one of the priority crops for many regions of the world including Myanmar. Its domestic production, local consumption and international trade were gradually progressed in Myanmar (MOAI, 2005).

Seed material is one of the costlier inputs in sugarcane and accounts for nearly 25% of the total production. The conventional use of three-eye setts imposes high cost to the estate and growers resulting in the shortage of planting materials. The use of high planting rates also forces an increase in the acreage of seed cane which competes for fertile land (Netsanet et al., 2014). The size of the cutting has a significant effect on both the percentage of germinated buds and the vigour of the cane plants (Croft, 2000).

The planting materials which have suitable sett size and seed rate, without any harmful effect on plant stand, may help in receiving higher cane yield with lower cost of production (Patel and Rinku, 2014). Moreover, pre-planting treatments should be used to protect the crop from soil borne diseases, sett rotting and damage to buds which affected the germination. It may be achieved about 60% by sett treatment which is quite simple and cheap (Sundara, 1998).

In Myanmar, most of the sugarcane farmers used to grow three-budded setts as planting materials without pre-planting treatments. It seems that three-budded setts generally cannot give the uniform germination as of an individual bud and damage to the setts can cause large gaps along the cane rows. To overcome the poor germination and poor crop stand, the suitable cane treatments, cane sett size and planting methods are essential for commercial sugarcane planting. Based on the above information, it seems that the evaluation of germination is still the critical component in sugarcane cultivation as well as varietal assessment before releasing a new variety (Sanda Kyaw Win and San Thein, 2006).

OBJECTIVES

This study aimed to find out the suitable seed cane treatment for uniform germination and crop stand, and to compare germination percentage and vigorous of sugarcane affected by seed cane treatments and planting methods.

METHODOLOGY

These glasshouse experiments were conducted in 2×4 factorial arrangement in Randomized Complete Block (RCB) design with three replications in Sugarcane Research and Development Farm, Pyinmana. It evaluated on two different planting methods (single budded setts and three budded setts) with three pre-planting treatments which include different levels of lime (0, 7.5, 15, 22.5 g l^{-1}), different levels of topsin fungicide (0, 0.5, 1, 1.5 g l^{-1}) and different degree of hot water (0, 50, 52, 54˚C). Zero (0) levels in each experiment referred to as control treatments. The cane setts used in all treatments were cut into single budded setts and three budded setts before planting. These two sets of cane setts cuttings were soaked in each solution of different pre-planting treatments for 30 minutes.

The numbers of shoots germinated were counted at 3 days interval from 4 to 45 days after planting (DAP). The WGP and FGP were calculated by the equation (1) and (2) (Al-Mudaris, 1998).

$$\text{Weighted Germination Percentage (WGP)} = \frac{[r^{th} \times n_1 + (r-1)^{th} \times n_2 + \cdots + 1^{th} \times n_{15}]100}{15 \times N} \quad (1)$$

Where n_1, n_2,…, n_{15} are the number of cane setts germinated on the 1st, 2nd and consequent days until 45 DAP in each which is multiplied by the counting times, r^{th} (up to 15th count in this experiment). The weighted germination percentage (WGP) was calculated by giving maximum weight to the seeds that germinated first and progressively less weight to that germinated setts subsequently. N is the total number of eye buds placed for germination.

Final germination percentage - Germination count is only based on the number of eye-buds per row, regardless of the cane sett length.

$$\text{Final Germination Percentage (FGP)} = \frac{\text{final number of shoots germinated}}{\text{total number of eye buds seeded}} \times 100 \quad (2)$$

The data were subjected to analysis of variance by using Statistix (version-8) software and mean comparisons were done by Least Significant Different (LSD) at 5% level.

RESULTS AND DISCUSSION

Weighted Germination Percentage (WGP) and Final Germination Percentage of Lime Experiment

There was highly significant different in weighted germination percentage (WGP) in lime experiment. In lime experiment, single budded setts gave faster germination speed, also called WGP than three budded setts overall in Table 1, although they were the same germination percentage at last. There was 482.02% in WGP in single budded sett planting whereas 360.25% WGP in three budded sett planting method. However, there was no difference in the germinated buds at the end, which both accounted for nearly 87% of final germination percentage (FGP). According to Singh and Gurpreet (2015), a small volume of tissue and a single root primordial adhering to the bud are adequate to ensure germination of the bud. This finding was also observed by Chen et al.1981 that pretreatments such as soaking the seed cuttings in solutions of $CaCO_3$, $MgSO_4$, and KOH could enhance the germination of sugarcane cuttings under laboratory conditions.

Fig. 1 shows that different levels of lime treatment were statistically significant in WGP in two planting methods but not in FGP. There was no noticeably different in WGP in each planting methods but single budded sett planting method is superior to three budded sett planting. The lime level (7.5 g l^{-1}) should be selected because of low amount of dosage which would be economical for the farmers.

Table 1 Comparison of WGP and FGP in different levels of treatments in two planting methods

Planting Methods	Lime Experiment		Fungicide Experiment		Hot Water Experiment	
	WGP (%)	FGP (%)	WGP (%)	FGP (%)	WGP (%)	FGP (%)
Single budded setts	482.02 a	87.77 a	493.79 a	92.22 a	367.22 a	75.55 a
Three budded setts	360.25 b	87.22 a	355.05 b	83.88 b	321.82 a	81.66 a
$LSD_{0.05}$	42.87	10.49	33.23	7.86	51.37	9.47
Pr>F	<0.01	0.91	<0.01	0.04	0.08	0.19
CV%	11.63	13.70	8.94	10.20	17.03	13.77

Mean values followed by the same letter in each column are not significantly different at 5% LSD level.

Weighted Germination Percentage (WGP) and Final Germination Percentage (FGP) of Topsin Fungicide Experiment

As in lime experiment, the two planting methods were highly significantly different in WGP in topsin fungicide experiment (Table 1). Single budded sett planting method gave the higher speed of germination than three-eye setts. The WGP in single budded sett was 493.79% which was almost one-third higher than that of three budded sett planting (355.05%).

There was also significant different in final germination percentage in fungicide experiment at LSD 5% level. Single budded sett planting showed the higher germination which accounted for 92.22% compared to the 83.88% in FGP of three budded sett planting (Table 1). Talukder et al. (2007) reported that systemic fungicides helped in improving sugarcane sett germination by the protection from the fungus disease and similarly significantly increased the cane yield.

In Fig. 2, it can be concluded that single budded sett planting was higher in WGP and FGP in each different levels of topsin fungicide treatments. None of topsin fungicide treatments were significantly different with each other in both WGP and FGP except the control treatments (zero level of fungicide which means spraying water only to the plants). Therefore, the lowest level of topsin fungicide (0.5 g l^{-1}) can be recommended to treat the cane setts before planting if the growers wished to use fungicide treatments.

Weighted Germination Percentage (WGP) and Final Germination Percentage (FGP) of Hot Water Experiment

In hot water experiment, there were not statistically different in weighted germination and final

germination in both planting methods (Table 1).

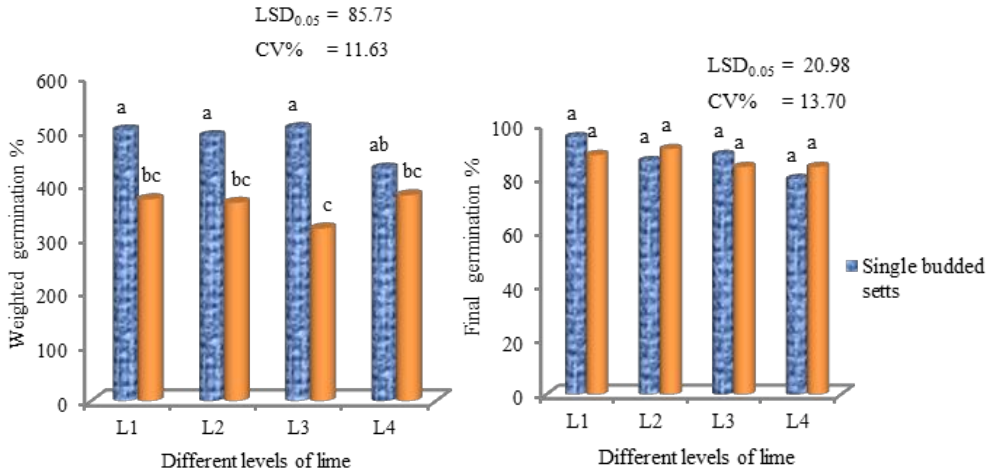

Fig. 1 Weighted germination percentage (WGP) and final germination percentage (FGP) as affected by different levels of lime treatment in two plating methods

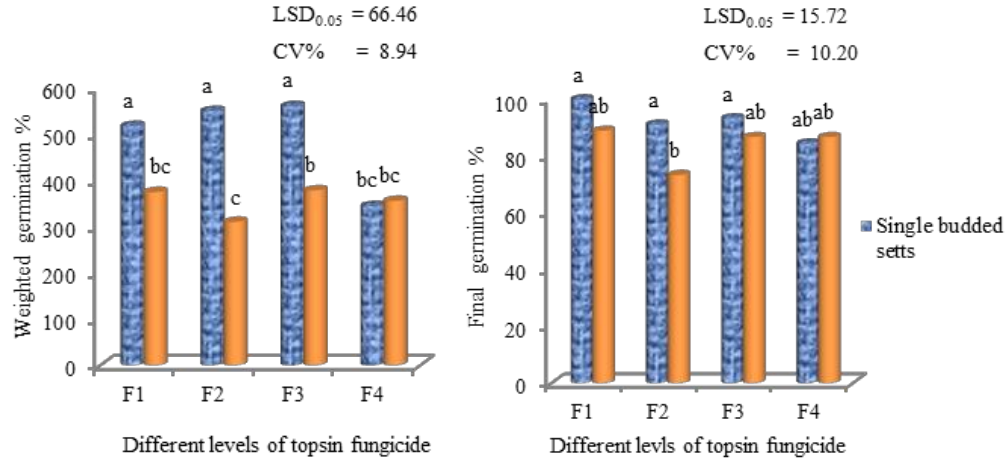

Fig. 2 Weighted germination percentage (WGP) and final germination percentage (FGP) as affected by different levels of topsin fungicide treatment in two planting methods

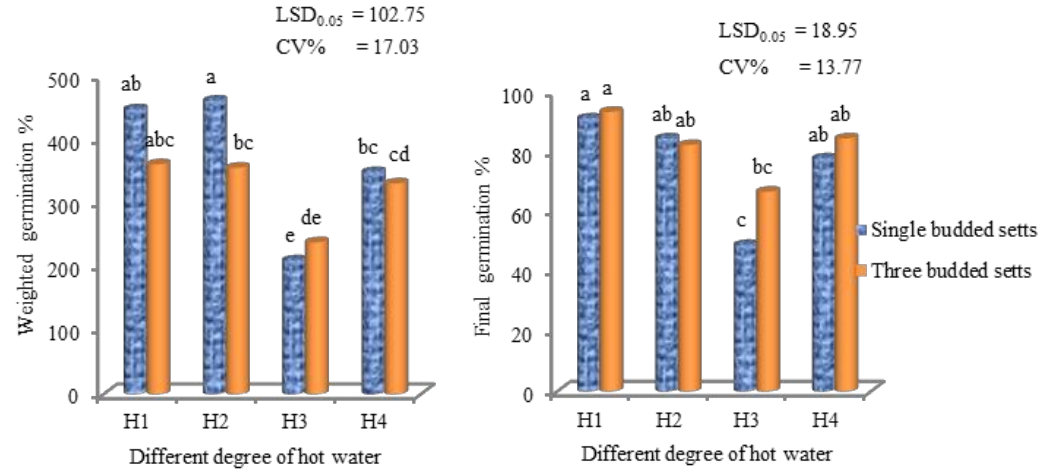

Fig. 3 Weighted germination percentage (WGP) and final germination percentage (FGP) as affected by different degree of hot water treatment in two planting methods

However, the combined effect of planting methods and different levels of hot water treatments were significantly different in both WGP and FGP (Fig. 1). The hot water level (52˚C) showed the highest percentage in WGP in both planting methods which was not statistically differ from 50˚C of hot water. The slowest speed of germination was observed at the hot water level (54˚C). Trippi (1961) stated that the germination of the buds in sugarcane cuttings was stimulated by hot water treatment at 50˚C. Similarly, Goodall (1998) reported that ratoon stunting disease is eliminated and germination is not unduly adversely affected by using the shortening heat treatment.

CONCLUSION

In conclusion, these experiments were conducted to determine the suitable seed cane treatment for sugarcane germination which will support for the farmers in choosing the seed cane treatment before planting. In addition, the experiment can reveal the suitable planting method for the farmers who normally familiar with the three budded sett planting techniques in Myanmar.

The results showed that single budded sett planting gave the higher germination percentage in terms of speed and the final germinated buds. Single budded sett planting were higher in WGP than those of three budded sett planting method in both lime and topsin fungicide treatments.

Among the different levels of treatments, the lowest levels of lime, topsin fungicide and hot water degree showed the higher percentage and speed of germination in both planting methods. As a recommendation, this research should be undertaken for further study in different regions and different seasons of the country to verify the strong result in sugarcane cultivation.

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