

## Prediction of Sweet Corn Seeds Field Emergence under Wet Soil Condition

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### ABSTRACT

Field emergence prediction of sweet corn seeds under wet soil conditions was studied using three different quality seeds of Hawaiian Sugar Super Sweet and Super Sweet Argo Extra MT varieties. The seeds were subjected to germinate in sand at room temperature. Germination was evaluated for 7 days after planting (DAP). Flooded germination was done by planting the seeds in 1000 g of clay soil in a plastic basket, flooding at 1 cm above soil level for 5 hours and evaluating at 7 DAP. Field emergence was studied under daily watering, three times a day, to simulate wet planting soil condition. Field emergence evaluation was performed at 7 DAP. Results showed that the sweet corn seeds with 79.50-91.00% germination of Hawaiian Sugar Super Sweet and Super Sweet Argo Extra MT varieties had field emergence of 61-79% under wet soil condition. The lower quality seed had the field emergence of lower than 60%. Sand germination and flooded germination in clay soil did not correspond to field emergence under wet soil condition. The field emergence under wet soil condition of sweet corn seeds could be predicted by the polynomial equations which gave better results than sand germination test.

**Key words:** field emergence, wet soil condition, sand germination, flooded germination, sweet corn seeds

### INTRODUCTION

Germination test is an analytical procedure to evaluate seed viability under standardized (favorable) laboratory conditions (ISTA, 1999; AOSA, 2001). The percentage of germination reflects the planting value of a seed lot (Liu *et al.*, 1999). However, it was frequently found that standard germination did not correspond to the field performance under stress planting conditions (Delouche and Baskin, 1973; Vieira *et al.*, 1999). Sand germination test in room temperature for corn seeds has been used widely

in many of the developing countries, due to simple and low cost test, and using less specific equipment. Most importantly, result of the test has to be highly accurate with standard germination (Dungpatra, 1986). Many crop production areas, including Thailand, are faced with heavy raining in the planting season which resulted in wet soil condition in the planting field (Martin *et al.*, 1988; Jittham, 2002). Some vigor tests have been develop for more accurate prediction for field emergence under the stressful planting condition in corn (Sawatdikarn, 2002), sweet corn (Jittham, 2002) and cucumber (Werakul, 2003) in the humid

tropics. The purpose of this study was to investigate the relationship between sand germination and field emergence and flooded germination in predicting potential to field emergence under wet planting soil condition.

## MATERIALS AND METHODS

Two varieties, namely Hawaiian Sugar Super Sweet and Super Sweet Argo Extra MT commercial corn seeds obtained from Songkhla Field Crop Research Center and a seed company were used as high quality seeds with germination of 86.50-91.00%. The seed samples having different germination percentage (74.50-79.50 and 53.50-66.00%) after accelerated aging at 42°C (AOSA, 2002) for 48 and 96 hours were used as medium and low quality seeds, respectively. All tests were done with four replications.

### Sand germination

Fifty seeds per replication were subjected to germinate in 1,000 g sand in plastic basket at room temperature and were watered daily. First and final counts were done at 4 and 7 days after planting, respectively (AOSA, 2001). Normal seedlings were averaged as the germination percentage.

### Flooded germination test

Fifty seeds per replication were subjected to germinate in 1,000 g of clay soil in plastic basket at room temperature. The planting baskets were placed in plastic trays and were flooded at 1 cm above soil level for 5 hours. After the end of flooding duration, the water was drained (the soil moisture content was still near to saturation after drainage) and the seeds were placed for further germinating. The germination percentage was evaluated 7 days after planting (Jittham, 2002).

### Field emergence under wet soil condition

Fifty seeds per replication were planted

at a depth of 2.5 cm in clay soil of the experimental field of Division of Agricultural Technology, Prince of Songkla University, Pattani. Irrigation was given daily for three times a day, morning, noon, and evening, to simulate wet planting field condition. Also in the each irrigation time, the soil was watered till wet. The normal seedlings were counted at 4 and 7 days after planting, respectively. Field emergence percentage was calculated using the same procedure as described in AOSA (2001).

Analysis of variances for a completely randomized design among sand germination, field emergence, and flooded germination was performed. The statistical significance of differences among means was tested by Duncan's Multiple Range Test (DMRT). The relation between sand germination and field emergence were plotted as well as mathematical equations for predicting the field emergence which are also presented as polynomial.

## RESULTS AND DISCUSSION

Comparison of the sweet corn seed germination among sand, flooded condition, and wet field planting condition was undertaken (Table 1). The sweet corn seeds with 79.50-91.00% germination of Hawaiian Sugar Super Sweet and Super Sweet Argo Extra M.T. varieties had field emergence of 61-79%. The lower quality seeds had the field emergence of lower than 60%.

Seeds of Hawaiian Sugar Super Sweet and Super Sweet Argo Extra MT varieties in sand test showed significant higher germination percentages than field emergence under wet planting field condition. The seeds germinated in soil in baskets under the flooded condition gave lower germination percentage than those in both sand test and under the field condition. This is not in agreement with the earlier report by Jittham (2002) that the flooded germination gave the same germination percentage as field emergence in rainy season planting. This is probably due to the

difference of soil texture used in the flooded germination test causing different results. The high amount of water holding after drainage in clay soil used in this study might cause more reduction of oxygen diffusion and become more compact during the germination period comparing to sandy

loam soil, and as a consequence sweet corn seed germinability dramatically reduced.

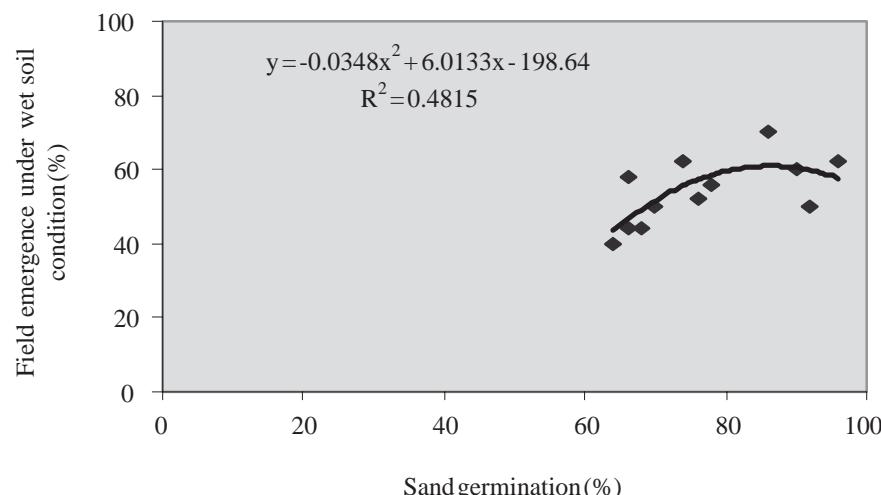
Sand germination showed a significant correlation with field emergence both in Hawaiian Sugar Super Sweet corn ( $r=0.694^*$ ) (Figure 1) and Super Sweet Argo Extra MT corn ( $r=0.919^{**}$ )

**Table 1** Germination of Hawaiian Sugar Super Sweet and Super Sweet Argo Extra MT corn seeds with three quality classes tested in sand, flooded condition and under wet field condition.

Test methods and field conditions	Germination (%)		
	High	Medium	Low
Hawaiian Sugar Super Sweet			
Sand	91.00 A	74.50 A	66.00 A
Flooded condition	13.00 C	11.00 C	7.50 C
Wet field condition	60.50 B	55.00 B	46.50 B
F-test	**	**	**
C.V. (%)	12.73	12.31	14.05
Super Sweet Argo Extra MT			
Sand	86.50 A	79.50 A	53.50 A
Flooded condition	48.00 C	27.00 B	29.00 C
Wet field condition	79.00 B	77.00 A	41.50 B
F-test	**	**	**
C.V. (%)	6.47	12.75	17.26

\*\* = significant at  $P < 0.01$ .

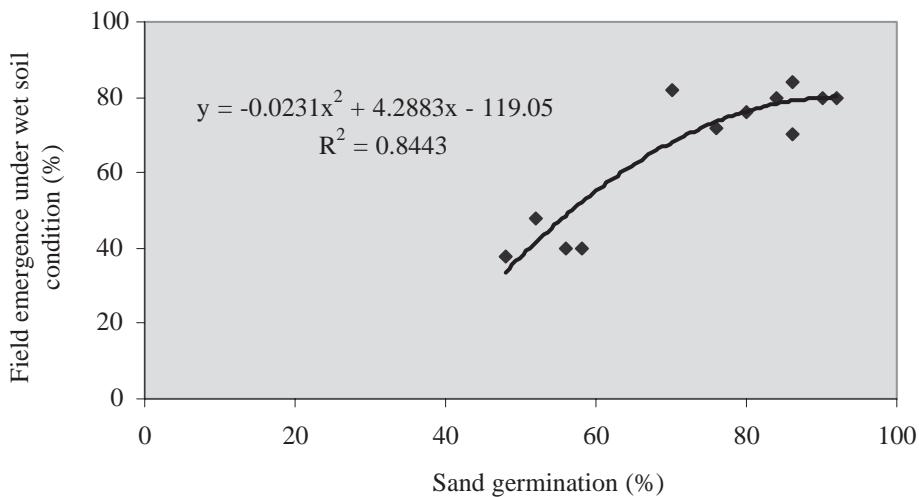
Means not sharing the same letter in each column of each variety are significantly different by DMRT.



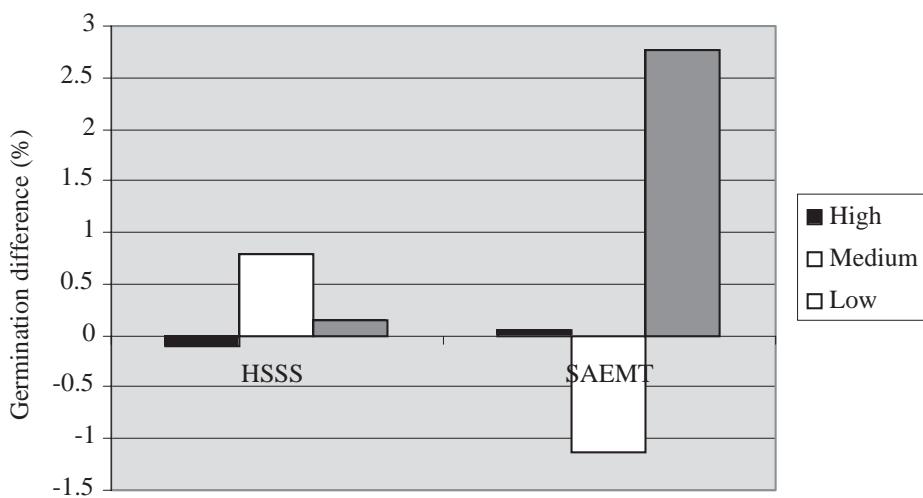
**Figure 1** Relation between sand germination and field emergence under wet soil condition of Hawaiian Sugar Super Sweet corn seeds,  $r=0.694^*$ .

(Figure 2). This is in agreement with the previous report by Kulik and Schoen (1982) that emergence of sweet corn seeds in sand bench was highly correlated with field emergence. However, sand germination could not predict seedling emergence of sweet corn under wet soil condition or in rainy planting season as data shown in Table 1. The

results of this study showed that percentage of field emergence calculated using the mathematical equation, polynomial, is very closely to field emergence (Figure 3). The data suggested that in sweet corn, the calculated field emergence is superior to sand germination and flooded germination tests in predicting field emergence



**Figure 2** Relation between sand germination and field emergence under wet soil condition of Super Sweet Argo Extra MT corn seeds,  $r=0.919^{**}$ .



**Figure 3** Germination differences between the predicted field emergence and field emergence under wet soil condition of different quality seeds of Hawaiian Sugar Super Sweet (HSSS) and Super Argo Extra MT (SAEMT) corn.

under wet soil condition planting.

Additional evaluations of other varieties and lots as well as hybrid varieties are needed to confirm the present results and to investigate more optimum mathematical equation which could be widely used in most sweet corn. Future study should also be conducted to relate field emergence results to drought planting condition.

## CONCLUSION

1. Sweet corn seeds with 79.50-91.00% germination of Hawaiian Sugar Super Sweet and Super Sweet Argo Extra MT varieties had field emergence of 61-79% under wet soil condition. The lower quality seed had the field emergence of lower than 60%.

2. Sand germination and flooded germination in clay soil did not correspond to field emergence under wet soil condition.

3. The field emergence under wet soil condition of sweet corn seeds could be predicted by the polynomial equations obtained from relationship between sand germination and the field emergence which gave better results than sand germination test.

## ACKNOWLEDGEMENTS

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