

PHYSIOLOGICAL AND GROWTH RESPONSES OF  
PINEAPPLE (*Ananas comosus* (L.) MERRILL) IN  
DIFFERENT LEVEL OF SALINITY AND DROUGHT  
STRESS UNDER IN-VITRO CULTURE

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MASTER OF SCIENCE  
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**The Thesis is Submitted in Fulfillment of the Requirement for the  
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## DEDICATION

*The thesis is special dedicated to my beloved parents,*

*Mr. Abdullah bin Ibrahim and Madam Sa'arah binti Sabtu,*

*For their never ending love and who always pray for my success and guided me through life.*

*To my dear brothers and sisters,*

*Muhd Afandi, Mohd Akmal, Norsuryani, Muhd Rahmat and Nur Suhadah,*

*Thank you for supporting my aspirations with love and encouragement, regardless of the distance.*

*To my treasure friends,*

*Masita Mohammad, Wan Nadilah Adibah W. Ahmad and Rosyida Rosdi,*

*Thank you for love, support, endurance, patience and belief on me.*

*— Thank you very much —*

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**FEBRUARY 2009**

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The areas along the coastal line of the East Coast of Peninsular Malaysia are largely covered with the 'Beach Ridges Interspersed with Swales' (BRIS) soil, where it is commonly faced with salt deposit problem and having severe drought condition during the middle of the year. The BRIS soil contains low water holding capacity, less nutrient and not suitable for cultivation of many crops species. Pineapple (*Ananas comosus* (L.) Merrill) is recorded as a crop originated from the arid region of the Central America, and it is believed to be tolerant under drought condition and might be very suitable to be cultivated in the BRIS (Beach Ridges Interspersed with Swales) soil area. Thus, a study was conducted to examine the effect of salinity and drought stress on three cultivated varieties (cultivar) of pineapple, namely N36, Morris and Sarawak, by using the tissue culture techniques with the aim at determining the best pineapple variety for and cultivating under the BRIS soil condition.

The salinity and drought experiments were carried out separately. The salinity effect was treated using NaCl in the culture medium; while the drought culture condition was obtained by addition of mannitol into the culture medium. A 10-15 mm size of pineapple explants were excised from the three months old stock plantlets prior cultured in 25 mL test tube containing 10 mL solid Murashige and Skoog (MS) medium supplemented with NaCl or mannitol; NaCl was added at either 0 (control), 34, 68, 103, 137, 171, 205 or 240 mM. Mannitol was added at either 0 (control), 22, 44, 66, 88, 110, 132 or 154 mM. At four weeks after culturing, the biomass (fresh and dry weight), plantlet height, leaves number, proline content, malate accumulation, mineral composition, chlorophyll and carotenoid content of the plantlets were assessed.

The result revealed that the growth of pineapple was inhibited at all salinity level tested. Higher salinity level (171 to 240 mM) had significantly reduced biomass, plant height and leaves number of pineapple varieties, albeit do not completely inhibit the growth of the plantlets. Salinity has increased the proline content in pineapple however the level of proline was varietal dependent. The salinity level at 68 mM has reduced malate content of N36 while malate content of Morris and Sarawak reduced at 103 mM salinity level. Increasing in salinity level also reduced the K, Ca, Mg and P content in pineapple tissue however Na and Na/K were increased with increasing the salt concentrations. Low salinity level (68 mM) enhanced the Chl *a*, Chl *b* and caratenoids content of pineapple.

The results also indicated that the growth of pineapple was also affected by different levels of mannitol. The biomass, plant height and leaves number of pineapple were

vary with increase of mannitol concentrations. In contrast, proline content of pineapple was increased with increasing of mannitol level, where the content was highest at 110 mM mannitol, but eventually decreased with more increase of mannitol level (132 and 154 mM). Malate content was highest at mannitol level 66 mM but slightly decreased with increasing the mannitol level (132 and 154 mM). The mineral content (Na, K, Ca, Mg and Na/K ratio) of the plantlets was fluctuated at all mannitol concentrations. P content decreased at low mannitol level (44 to 66 mM). Mannitol level 44 mM increased Chl *a*, Chl *b* and carotenoids content of pineapple variety Morris.

This study found that Sarawak variety was the most tolerance pineapple under salinity and drought stress conditions imposed by high levels of NaCl and mannitol under tissue culture condition. Therefore, it is recommended that the variety could be used as the most suitable crop to be tested for cultivating in the BRIS soil area.