CHAPTER 1

INTRODUCTION

Maize (*Zea mays* L.) is grown throughout the world as a very important staple food crop for vast numbers of humankind. Maize is planted a round the world and there were about 157 countries producing maize in 2003 (FAO. 2003). The total area in the world for maize production was 142,331,335 hectare (ha), but only two countries together - the US and China - produced over half of the total amount. The total yield production of maize in the world was 637,444,480 tons, and average yield was 3.41 t/ha (FAO. 2003). In the tropics maize is second in importance after rice in terms of cultivated area and production. Maize is a crop that is adapted to various climates in tropical, sub-tropical and temperate areas and has maturities from 70 days to 210 days (Belfield and Brown, 2008). Global climate change is now generally accepted to be underway (Hillel and Rosenzweig, 2002), and is expected to result in a long-term trend to have higher temperatures, greater evapotranspiration, and an increased incidences of drought in specific regions. Drought stress is the most wide spread abiotic constraint for maize production in the tropics, where most maize is grown under rainfed condition. In Thailand, drought was reported as a primary constraint for maize production in many agro-ecozones and it was observed almost every year (Ekasingh *et al.*, 2004). In maize-growing regions in China, when drought stress occurs just before and during the flowering time, water stress results in increased length of the anthesis-silking interval and

severe loss of yield (Li *et al.*, 2002). However little is known about drought stress response within tropical maize cultivars.

In Cambodia maize is planted in upland rainfed areas without irrigation (Belfield and Brown, 2008). Total cultivated area for maize production in 24 provinces in 2004 - 2005 was 85,043 ha, but the harvested area had 71,380 ha only. The average yield was 3.432 t/ha. The cultivated area damage by drought reported to be 13,663 ha, with a loss of 46,891 tons in grain yield to drought in 2004, worth US$ 871,247 to 2,799,488 (MAFF Cambodia, 2005).

The biggest cultivated area for maize production in Cambodia is in two provinces, Battambang and Kampong Cham, which together produced over half (58%) of Cambodia's total. Rainfall was recorded at 995 mm in 2004, 1092.2 mm in 2005, 1303.4 mm in 2006 and 1086.2 mm in 2007 at Battambong province and 1,271 mm in 2004, 2673.9 mm in 2005, 1170.9mm in 2006 and 998.8mm in 2007 at Kompong Cham province (Unpublished data from Battambang and Kompong Cham meteorology stations, 2004 to 2007), however, there is much year to year variation. Maize is grown on two major upland soil types, lebansiek (pH 5.5 to 5.8) and kompong siem soil types (pH 5.7 to 6.7) (Belfield and Brown, 2008). It is also grown on lowland rice soils that are hard setting, poorly structured and low in nutrient levels due to leaching. Yields on these soils are very low and maize production is considered as low or non profitable. Achieving high maize yield on these soils requires high levels of soil fertility (Belfield and Brown, 2008). Water stress can make nutrient deficiency worse by depressing plant nutrient uptake from soil.

The overall aim of this study is to evaluate how maize varieties differ in their response to stress and how this is related to uptake efficiency of the primary nutrients: nitrogen (N), phosphorus (P) and potassium (K).

Specific objectives of this research are:

1. To evaluate the effect of drought on maize growth and focus on nutrient uptake efficiency of N, P and K.
2. To evaluate the effect of water stress of maize varieties on root growth.
3. To identify genotypic variation in response to water stress in maize.