SUMMARY AND CONCLUSIONS

Relationships among plant characteristics of 31 maize genotypes, were significantly interrelated, but the magnitude of correlation coefficients was relatively low. Whereas, high magnitude of correlation was found between kernel yield with biomass (r = 0.541**) and with ASI (r = - 0.376*), suggested that these two parameters can be used as indicators in screening of maize genotypes for drought tolerance.

Among the thirty-one maize genotypes, Cargill 922, Cargill 919, NSX 9605, Cargill 717, SW 3601, G 5431, Cargill 7140, DK 888, CP 222, G 5445, NSX 9608, NTX 9703, NSX 9601, NSX 9210, KK-DR, NSX 9213 and NSX 9607 genotypes classified as drought tolerant type due to the values of DI greater than 1.0 and less DSI values. Not all hybrids performed better than the open-pollinated varieties under drought environment.

The relationships between kernel yield potential and drought susceptibility can be used as a screening technique for drought tolerance. Cargill 7140, Cargill 919, Cargill 717, G 5431 and SW 3601 genotypes were identified as a drought tolerant type which can be grown under limited irrigation water as well as rainfed condition under erratic and rapidly diminishing rainfall. While genotypes DK 888, NSX 9607, NSX 9210, and G 5445 were classified as a moderately drought tolerant type which is suitable for the partial irrigation supply. Pacific 700, Pacific 300, Pioneer 3012, Cargill 7122, Cargill 727, Pioneer 3013, Pacific 300, Cargill 7118, G 5449 and NS 1 genotypes appeared to be the most drought susceptible type which could performed well under full irrigation.

In the 1998-1999 field experiment, SW 3601, NSX 9210 and NS 1 genotypes were selected to study the growth dynamics under different moisture regimes and determine the morphological and physiological responses to drought stress. Results showed that water deficit reduced total dry matter, kernel yield, crop growth rate, stalk growth rate, leaf growth rate, kernel growth rate, leaf area index and leaf area duration of all three maize genotypes, except, specific leaf weight was increased with increasing drought stress in both years. Water deficit exhibited lower leaf water potential, higher canopy temperature and greater stomatal resistance of leaf surface and also promoted leaf senescence in all genotypes.

Among the three genotypes, SW 3601 had higher yield and resisted greater water stress due to higher crop growth rate, higher partitioning coefficient, higher root density and extracted greater amount of water from deeper soil profile as compared to NSX 9210 and NS 1. SW 3601 also has a greater maintenance of leaf water potential, canopy temperature and stomatal resistance during the kernel filling period, and had lower leaf senescence. SW 3601 showed appeared to be the most drought tolerance which likely has the least DSI and a higher DI in both years as compared to NSX 9210 and NS 1. Among the yield components, kernel number and kernel weight were the most sensitive to drought followed by ear number. Results also showed that these two components were significantly correlated with kernel yield.

Results also confirmed that SW 3601 genotype (a drought tolerant type) performed best in the drought prone area, while NSX 9210 (a moderately drought tolerant type) was suitable for the partial irrigation water and NS 1 (a drought susceptibility type) could performed well under full irrigation.

In experiment 3 (1998-1999), water and nitrogen deficiencies affected growth and development in both vegetative and reproductive growth phase of maize genotypes. All genotypes when grown under nitrogen deficit exhibited a delay in the time to silking and maturity; whereas, tasseling was less affected by nitrogen stress as compared to those under high nitrogen.

Vegetative tissues, i.e., leaves, leaf sheath and stalk including tassel, acted as a major sinks of nitrogen during vegetative growth stage and then became as a sources during kernel development. While stalk and leaves serves as a major reservoir of both carbohydrates and reduced nitrogen for remobilization during the final stages of kernel filling. However, greater remobilization of reduced nitrogen compared to assimilation in both nitrogen levels were from stalk at the early kernel filling stage. While remobilization from stalk at low nitrogen fertility was rapidly decreased when severe drought occurred at the final stage of kernel development. Husks, silk and cob initially served as a sink for nitrogen and then became as sources during the reproductive phase. Whereas the kernel portion of nitrogen content for all genotypes steadily increased, those of the vegetative organs decreased, suggesting remobilization of nitrogen from vegetative and other reproductive tissues.

Among the three genotypes, SW 3601 produced the highest dry matter and nitrogen partitioning from vegetative tissues to kernels as compared to NSX 9210 and NS 1. It may be resulted in increases either in size or in efficiency of both source and sink. Kernel yield of all genotypes was also affected by water and nitrogen deficits. SW 3601 showed the most drought and nitrogen tolerance due to have the least value of DSI and the greater value of DI (>1.0) when compared to NSX 9210 and NS 1 genotypes. Dry weight and nitrogen deficits had a large effect on kernel yield by altering kernel number and kernel weight.

In conclusions, the differential response of these three maize genotypes differing in the degree of drought tolerance to water and nitrogen supplies provides a significant managerial option to tropical farmers to intensify use of their rice land. Among the three genotypes, SW 3601 could perform well in the drought prone area as well as in the partially irrigated area and also appears to be the best genotype to be grown both in the low and high nitrogen fertility areas.

Three Thai maize varieties differing in degree of drought tolerance which selected from field experiments were used to estimate the genetic coefficients for validation of the CERES-Maize model under irrigated condition. The overall performance of the CERES-Maize model illustrated satisfactory simulation of phenological events. This could help maize grower in managing time schedule for crop management in terms of the application time for fertilizer, pesticide, irrigation and harvesting time. The model also could help maize grower to predict the potential yield at the particular irrigated area.

To improve the productivity of maize grown after rice under paddy field, genotypes with a strong root ability to extract subsoil moisture deserves the high priority in varietal identification. A breeding program developed a newly maize variety with higher nitrogen use efficiency under paddy field condition should continue to alleviate environmental and economical problems. The model needs further calculate the newly-released hybrid varieties for genetic coefficient and needs test and validate for nitrogen and water management prior to the application of this model in strategies evaluation for maize grower of various locations. Hence, it will be more helpful for researcher to save financial resources and time consuming for field experiment which carried out to determine those conditions. In addition, the model will be more helpful for maize grower in kernel yield forecast if the model can take into account of losses from environment stress in terms of drought under rainfed area and waterlogging under irrigation area.