

jungle Sarawak 4.3% in 1997/1998 ENSO event. It is not easy to find patterns or response due to long drought against the types of plants. In Panama and East Kalimantan, large trees suffered more deaths than younger plants and shrub type (Condit et al. 1995; van Nieuwstadt and Sheil 2005).

Cocoa is one of the important crop in the world. Cocoa is produced by more than 50 countries located in tropical regions that are geographically can be divided into three regions namely Africa, Asia, Oceania and Latin America (Deptan, 2006). One of important factor influencing the production of cocoa is rainfall (Zuidema et al. 2005). The existence of global warming caused the climate change such as the long dry season which is associated with ENSO (El Nino Southern Oscillation). The climatologists predict these events will occur more often in the future (Nepstad et al. 2007). Socio-economic research about the effects of drought associated with ENSO on cocoa production in Central Sulawesi indicate that it could reduce cocoa production by 62% (Keil et al. 2008).

Plants in drought conditions will give a specific response in morphological, anatomical and physiological. In drought conditions the main mechanism that may occur in plants are trying to avoid stress, either by carrying out morphological and anatomical changes in the structure, as well as by improving water use efficiency by regulating the transpiration rate (Meyer & Boyer, 1981). Depending on the type of species and severity of drought, reduction in photosynthesis can be observed in the reduction of leaf area, leaf fall or delay the growth and development of leaves (Jones, 1992). Growth resulting from the interaction of all processes within a plant: photosynthesis, respiration, transport, water relations and nutrient balance. The growth includes the addition of dry mass, volume, length or area of cells (Lambers et al., 1998). Cell growth seems to be a process in which plants are most sensitive to water stress. Cell growth have two components: (1) cell division, and (2) cell expansion. Cell expansion depends on cell turgor (hydrostatic pressure) during their stay above the critical threshold. Under drought conditions in which the lower cell water potential, causing the expansion of cell growth is limited and declining growth (Lambers et al., 1998). This study aims to determine changes in the growth of cocoa plants that were 6 years old who were given drought stress with through fall displacement experiment (TDE) system for 13 months. Observation of growth parameters include the number of leaves per branch, leaf mass per area (LMA) and stem diameter.

