In addition, other important factors that influence the production of cocoa is rainfall (Zuidema *etal.* 2005). Cocoa plant requires a relatively equitable distribution of rainfall throughout the year without any dry months. Regional cocoa producers generally have rainfall between 1250-3000 mm per year. The existence of global warming caused the climate changes such as the long dry season which is associated with *ENSO (El Nino Southern Oscillation)*. Climatology experts predict these events will occur more often in the future (Nepstad *et al.* 2007). Research on cocoa plant drought stress responses has been a lot done, especially in *seedling*. However, information about the response of adult cacao plants (trees) to drought stress is still very small. In general, plants grown cacao agroforestry system with a few shade trees such as *Gliricidia sepium*. So far, a lot of information about the protective function of trees, especially in the provision of water for cocoa crop when the environmental conditions experienced drought stress. The purpose of this study was to determine the conductivity and root distribution of 6-year-old cocoa trees and *G.sepium*

MATERIALS AND METHODS

Research conducted in the village of Oahu, District of South Kulawi, Donggala which is the region around Lore Lindu National Park, Central Sulawesi Province, with an altitude of 585 m above sea level, and coordinates 1.5524 ° north latitude and 120.0206 ° east longitude. Cacao tree used in this study was 5 years old, while 6-year-old *G.sepium* tree. Each plot was taken six cocoa trees and three trees *G.sepium*. Every tree root system was taken three at a depth of 20 cm. Root conductivity determined by the method of Sperry et.al. (1988), whereas the root distribution is determined by making the soil pit as deep as 3 m. Variable observations made on December 2006-May 2008.

RESULTS AND DISCUSSION

Root conductivity

Based on the nature conductivity of cocoa in root *hydraulic conductance* shows the range of $1{,}75.10^{-5} \pm 1{,}68.10^{-3}$ - $6{,}19.10^{-5} \pm 5{,}38.10^{-5}$ $Kg.m.MPa^{-1}.S^{-1}$, while the roots of *G.sepium* has a range of $2{,}4.10^{-5} \pm 1{,}35.10^{-5}$ - $4{,}02.10^{-3} \pm 2{,}9.10^{-3}$ $Kg.m.MPa^{-1}.S^{-1}$ and embolism that occurred in the roots of cocoa 18-45% and root of *G.sepium* 9-71% (Prihastanti *et al.* 2009; Prihastanti, 2010). Based on conductivity properties of roots, the roots of cocoa trees have a low capacity in the stream water than *G. sepium*. The properties we shown in the *hydraulic conductivity* value, t percentage of embolism, which is smaller tha the root of *G. Sepium* (Prihastanti *et al,* 2009). Th situation is expected as an adaptation of t cacao tree has a shallow root system in the face changes in ground water tend to be more rapid reduced soil layer.

Root distribution

At 20 cm soil depth *fineroot* cocoa trees have higher life than living *fineroot G.sepium*. *Finero* lives of cocoa ranged from 94.52 to 181.57 g / m while living *fineroot G. sepium* 9.24 to 74.37 g / 3 (Prihastanti *et al,* 2010 in press). *Fineroot* roo dominance at 20 cm soil layer of cacao cause faster absorption of water so the soil moistur content decreased faster (Prihastanti *et al,* 2010 Press). According to Zuidema *et al.* (2005) an Susanto (1994) that lateral root cacao majorit (approximately 56%) grew on top soil as deep a 00-10 cm. While 26% in the deeper layers (11-2 cm), and approximately 14% in deeper part (21 30 cm), and only about 4.5%, growing at a depth of more than 30 cm. Besides, the growth relatively stable cocoa *fineroot* life while livin *G.sepium fineroot* growth tends to decline alon with the increase of time. That's because the to layer of roots *G.sepium* more dominated by *coars root* (Prihastanti *et al* 2010, in Press)

CONCLUSION

Cocoa root had low capacity in distributin water than that of *G. sepium*. Cocoa root were present to a depth of 150-160 cm, and the roots o *G. sepium* penetrated much deeper than those o cocoa, being present to a depth 275 cm. The different on root distribution and conductivity could be reducing competition for water and help to available water both cocoa and *G. sepium* tree.

REFERENCES

Darmajati, D. S. 2005. Indonesia cocoa : toward sustainable development. Director General Processing and Marketing of Agriculture Product. Ministri of Agriculture o Indonesia In Cocoa Symposium.

http://www.indonesia.go.id/id - REPUBLIK INDONESIA. 2009. Sosialisasi Gerakan Peningkatan Produksi dan Mutu Kakao Nasional

Nepstad, D. C., Tohver, I. M., Rav, D., Moutinho, P. 2007 Cardinot G. Mortality of large trees and lianas following experimental drought in an Amazon Forest. J. Ecology 88(9) : 2259-2269.

Prihastanti,E., S.Tjitrosemito, D. Sopandie, I. Qayim, C Leuschner. 2009. Pengukuran Nilai Hydraulic Conductance Dan Persentase Embolisme Pada Xilem Akar Kakao (Theobroma cacao L.) dan Gliricidia sepium