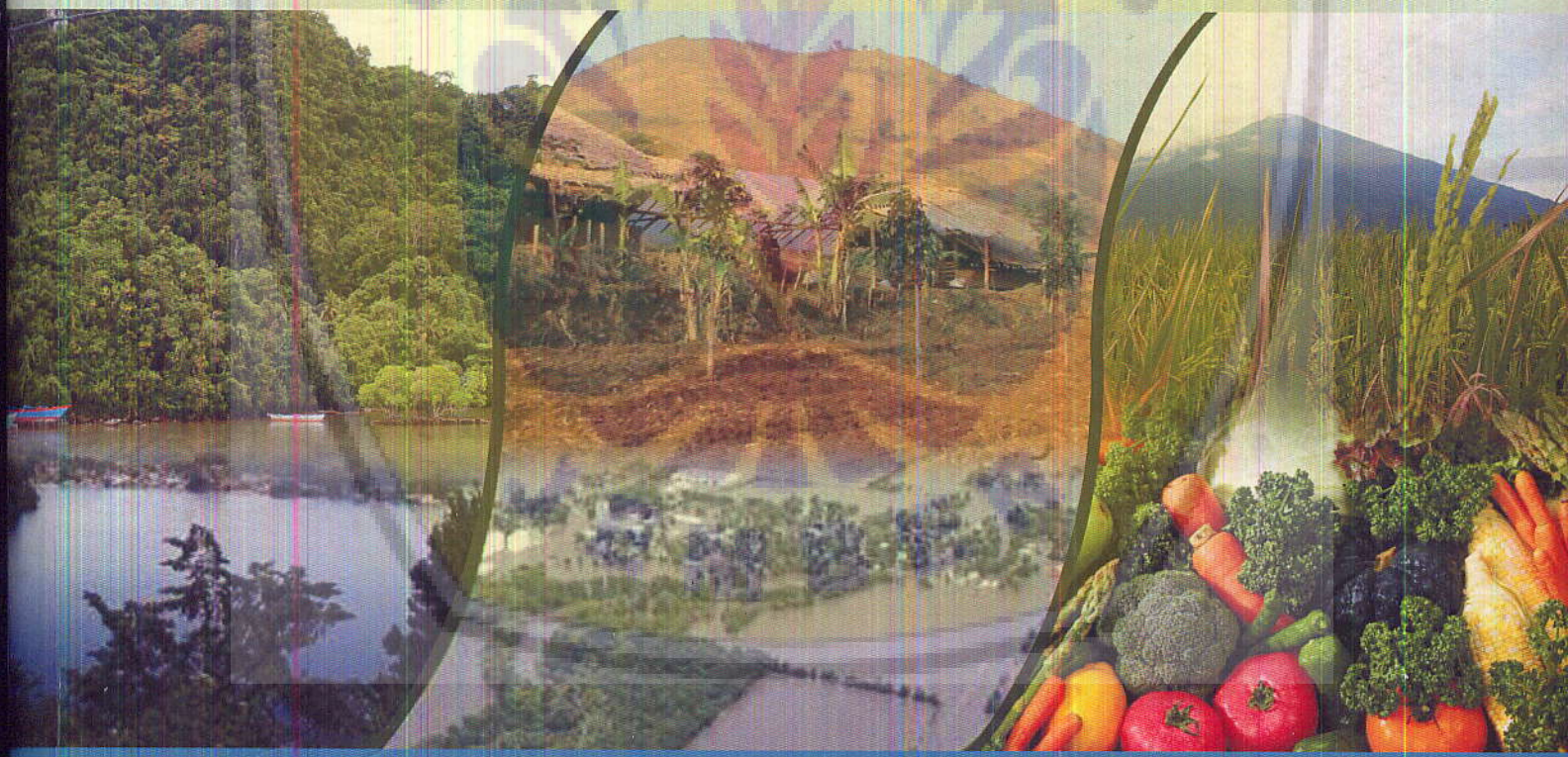
BOOK 1

ISBN : 978-602-8915-93-9

ISNAR-C2FS 2011

International Seminar on Natural Resources, Climate Change and Food Security in Developing Countries

Proceeding



UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN"

PHILIPPINE SOCIETY FOR THE STUDY OF NATURE ★ 2000 ★

International Seminar Natural Resources, Climate Change and Food Security in Developing Countries - ISNAR C2FS
June 27 - 28, 2011 Graha Pena Building, Surabaya - Indonesia
ISBN : 978-602-8915-93-9

Editorial Board

Editor :
Yonny Koentjoro

Assistant Editor :
Wahyu Santoso
Pangesti Nugrahani
Makhziah

Cover :
Magnificent Digital Printing by : Purnomo Edi Sasongko

Proceeding design :
Yonny Koentjoro and Wahyu Santoso

Published by : Faculty of Agriculture, University of Pembangunan Nasional "Veteran" East Java, Indonesia

Held in between :
- *Faculty of Agriculture, University of Pembangunan Nasional "Veteran" East Java, Indonesia*
- *Philippine Society for The Study of Nature (PSSN), Philippine*
- *CAB - University of Kasetsart, Thailand*

Sub Theme : Adaptation and Production
Oral Presentation

ISBN : 978-602-8915-93-9

EFFECT OF MULCHING BY CORN BIOMASS ON GROWTH AND PRODUCTION OF CORN IN DROUGHT CONDITION

Denna Eriani Munandar

Faculty of Agriculture, Jember University
Jl. Kalimantan, Tegalboto, Jember, Indonesia
e-mail : dennaeri@ymail.com

ABSTRACT

The lack of water in the dry season often causes problems for most agricultural products in tropical regions like Indonesia. Global climate change is often aggravating the condition by increasing uncertainty of seasonal changes; also more frequent of long dry season occurs. Corn is the second important food crop after rice in Indonesia that needs plenty of water for growth and high production. Use organic mulch of corn biomass is one alternative that is expected to overcome the water lack. This study examine the effect of mulching by corn biomass on the growth and production of three varieties of corn which was conducted in the dry season of 2009. Corn was planted on plots of 3 m x 6 m. Each plot contains four rows of plants with a spacing of 20 cm x 70 cm, in each row containing 25 plants of corn, so that each plot contained 100 plants. Plants were irrigated 2 times at the age of 15 and 45 days after planting. The design used was factorial completely randomized block design with 3 blocks (replications). The first factor was mulching by corn biomass with doses of 0, 5, 10 and 15 tons/ha, respectively. The second factor was corn varieties, namely P-21 (hybrid), Jaya (composite) and Madura (local composite). Data were analyzed by analysis of variance and Least Significant Difference (LSD) Test. The results showed that mulching by corn biomasss of 10 to 15 tons/ha gave the best effect on growth and yield of hybrid variety P-21.

Key word: Corn varieties, organic mulch, yield and production.

INTRODUCTION

Global climate change has an impact on various aspects of plant life. Observations over the last 30 years on coffee and cocoa plantations in the Jember region showed the increase of average daily temperature, daily maximum temperature, daily minimum temperature and relative humidity. The increase in average daily temperatures cause increased evapotranspiration, so that more crop water required. Without fulfill balanced provision of water more, plant will being drought. Global climate change can also cause a long dry season in some tropical regions, this often creates plant water shortages in some areas that water needs fulfilled by rainfall only. Corn is an important crop in Indonesia as sources of food, feed and raw material for industry. Corn is cultivated mainly on dry land. East Java

ISBN : 978-602-8915-93-9

produces about 71% of total corn produced in Indonesia. Corn is a crop that need plenty of water, especially during early growth, flowering and seed filling. Lack of water at these stages can reduce yield (Kasijadi et al., 2000; Pikukuh et al., 2000; Purnomo and Hartono, 2002). In dry season corn require irrigation as much as four times, i.e at the age of 15, 30, 45, and 60 days after planting in order to achieve an optimum yield (Aqil et al., 2007).

Modification of the root environment to maintain soil moisture is very important on dry land. Mulch is a material given to the soil either in the form of cover crops, plant residues (organic mulch), or from synthetic materials (inorganic) such as plastic. The main purpose of using mulch is to reduce direct evaporation from the soil surface, increase water availability in the soil, which further water can be absorbed by plants. Mulch also helped restoring the productivity of dry land, by protecting the soil aggregates from the destructive force of rain, increasing the absorption of water and nutrients by plants, maintain soil temperature, increase soil organic matter and suppress weed growth (Williams, 1997). Coffee plants that were given straw mulch absorbs water 6.3% more than the plants without mulch (Abdoellah & Soenaryo, 1986). Pramono et al. (1990) cit. Bahrudin (2003) resulted that straw mulching on onion can significantly increase the weight of bulb from 6 tonnes / ha to 8.94 tonnes / ha, or there is an increase of 49%.

In the cultivation of corn in Indonesia, its waste after harvest (biomass plants) are generally not returned to the ground, whereas that biomass could be used as an organic mulch to conserve water on dry land or in the dry season. Composite and local corn varieties such as Madura variety generally have a good adaptation to local climatic conditions including the occurrence of water shortage. High yield potential of corn under conditions of water shortage is the target of many researchers. In this study, corn stalks residue is used as organic mulch for three different corn varieties. Mulching is expected to increase corn production due to water saving by reducing evaporation and suppress weed growth, thereby reducing competition on plant nutrients used by corn cultivated.

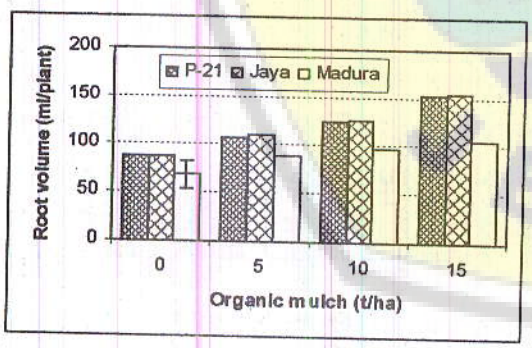
MATERIALS AND METHOD

The study was conducted during the dry season of 2009 in the Jubung Lor village, Sukorambi District, Jember, Indonesia; on Regosol soil and the altitude of 83 m above sea level. The average temperature at the study sites ranged between 26-32°C, light intensity ranged from 175000-385000 lux, and the relative humidity

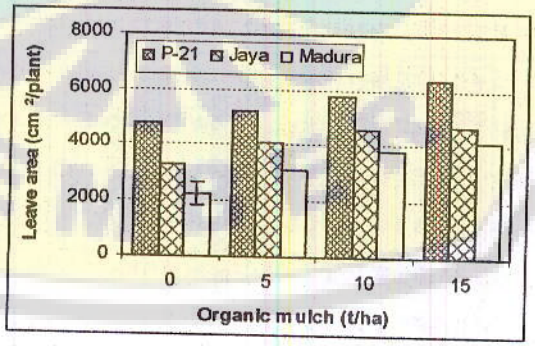
ranged between 65-80%. Experiment were arranged in factorially randomized complete block design. The first factor is the 3 varieties of corn, i.e P-21 (hybrid), Jaya (composite) and Madura (local composite); while the second factor is the dose of organic mulch derived from corn stalk residues as much as 0, 5, 10 and 15 tons of dry weight/ha. Corn is planted on plots of 3 m x 6 m, 100 plants/plot, with spacing of 20 cm x 70 cm. Plants watered twice at the age of 15 and 45 days after transplanting (DAT). Fertilization is done twice, at planting time as much as 1/3 parts and at 40 days after planting are given 2/3 part of mixed fertilizer of N, P2O5 and K2O at the doses of 100, 75 and 100 kg/ha respectively. Data of plant growth were observed at flowering phase, and harvesting were done when the pod is lightly browned. Soil moisture levels were analyzed every 15 days. Data were analyzed by analysis of variance at 5% significance level and followed by Least Significant Difference test at level of 5% to know the differences among the treatments. Data analysis was performed using a device DSAASTAT (Ver.1.0192).

RESULTS AND DISCUSSION

Based on the analysis of variance, organic mulching using corn biomass remaining significant effect on various growth parameters. In general, by increasing the dose of mulch, the better the growth and yield parameters. Corn varieties have different genetic potential in terms of productivity, as well as tolerance to drought. Giving different doses of mulch can lead to differences in moisture content contained in the soil due to differences in evaporation. Hybrid corn variety P-21 generally indicates the potential for growth and the highest result, while the local variety Madura generate growth and yield lowest at various levels of mulching.



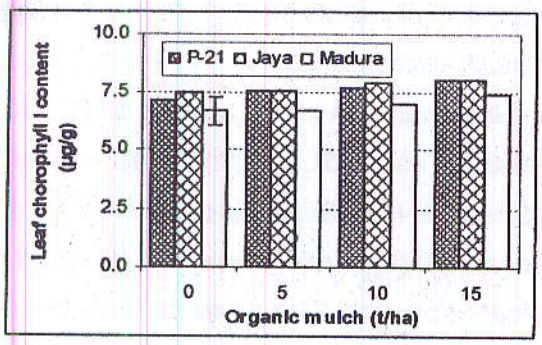
(1)



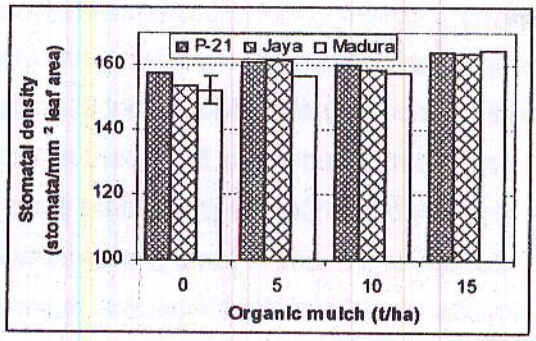
(2)

Figure 1. Root volume of three corn varieties at various doses of organic mulch (LSD 5% = 14,78)

Figure 2. Leaf area of three corn varieties at various doses of organic mulch (LSD 5% = 394.14)



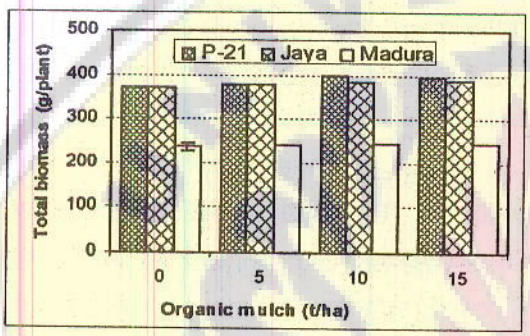
(3)



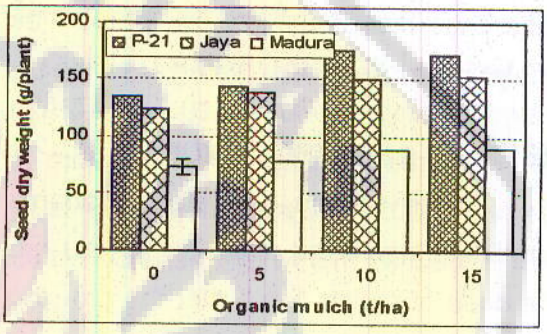
(4)

Figure 3. Leaf chlorophyll content of three corn varieties on some organic mulch doses (LSD 5% = 0.603)

Figure 4. Stomatal density of three corn varieties on some organic mulch doses (LSD 5 % = 4.23)



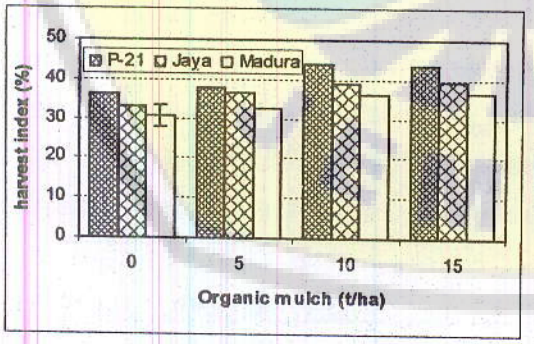
(5)



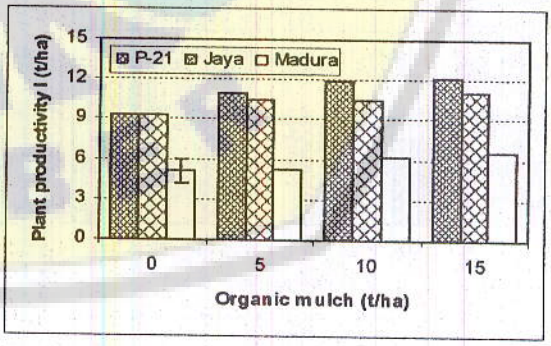
(6)

Figure 5. Total biomass of three corn varieties on some organic mulch doses (LSD 5% = 8.75)

Figure 6. Seed dry weight of three corn varieties on some organic mulch doses (LSD 5 % = 7.00)



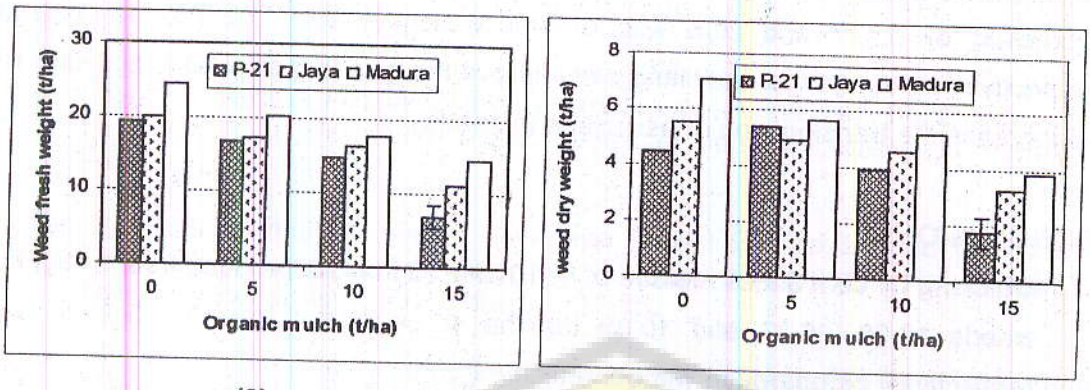
(7)



(8)

Figure 7. Harvest index of three corn varieties on some organic mulch doses (LSD 5% = 2.68)

Figure 8. Plant productivity of three corn varieties on some organic mulch doses (LSD 5% = 0.89)



(9) (10)

Figure 9. Weed fresh weight grown under three corn varieties on some organic mulch doses (LSD 5 % = 1.51)

Figure 10. Weed dry weight grown under three corn varieties on some organic mulch doses (LSD 5% = 0.54)

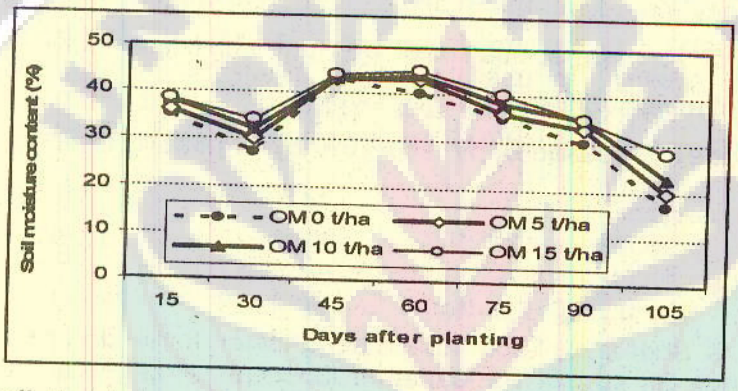


Figure 11. Soil moisture content of organic mulch treatment observed at some days after planting.

The different varieties of corn and treatments of organic mulch doses produce different weed growth significantly. Land planted by corn hybrids P-21 and composite Jaya produce less weed than corn planted with Madura variety (Figure 9 and 10), this is due to habitus of Madura corn is much smaller than the two other corn, so that with a spacing of 20 cm x 70 cm it is remaining loose enough free space for the growth of weeds. The addition of organic mulch biomass of corn as much as 5, 10 and 15 tons/ha suppresses weed fresh weight per hectare by 15, 23 and 48%. Application of organic mulch biomass of corn as much as 5, 10 and 15 tons/ha has increased the productivity of hybrid P-21 until 7, 30 and 28%, increased the productivity of composite Jaya at 13, 22 and 25% and increased the productivity of the local corn Madura variety of 8, 22 and 24%. P-21 produced the highest seed dry weight, i.e 175.92 g/plant by mulching of 10 tons/ha, this result was not

ISBN : 978-602-8915-93-9

significantly different compared to the dose of mulch 15 tons/ha. Harvest index increased by 6, 17 and 20% with organic mulching at 5, 10 and 15 tons/ha, respectively. It shows that mulching can improve the growth and yield of corn as well as increase the translocation of assimilate to seeds.

CONCLUSION

1. Mulching by corn stalks residue of 5, 10 and 15 tons/ha produce fresh weight of weeds 18.08, 16.23 and 10.89 tons/ha or decreased by 15, 23 and 48% respectively compared to without mulch.
2. Mulching by corn stalks residue of 5, 10 and 15 tons/ha increase the productivity of corn hybrid P-21 by 7, 30 and 28%; increase the productivity of composite Jaya by 13, 22 and 25% as well as local Madura variety of 8, 22 and 24%.
3. P-21 variety produced the highest seed dry weight, i.e 175.92 g/plant by mulching of 10 tons/ha, this result was not significantly different compared to the dose of mulch 15 tons/ha.
4. Harvest index increased 6, 17 and 20% by organic mulching at 5, 10 and 15 tons/ha.

REFERENCES

Abdoellah, S. & Soenaryo. 1986. Kajian pengolahan tanah dan penggunaan mulsa di pertanaman kopi. I. Pengamatan tahun pertama. *Pelita Perkebunan* 2(3), 93-96.

Akil, M. & H.A. Dahlan. 2007. Budidaya Jagung dan Diseminasi Teknologi. *Dalam* Jagung, Teknik Produksi dan Pengembangan. Badan Penelitian dan Pengembangan Pertanian, Pusat Penelitian dan Pengembangan Tanaman Pangan, 192 – 204.

Anonymous. 2000. Sumberdaya Lahan di Indonesia dan Pengelolaannya. Pusat Penelitian Tanah dan Agroklimat. Badan Penelitian dan Pengembangan Pertanian. Departemen Pertanian. pp. 266.

_____. 2008. Impact of Drought on Corn Physiology and Yield. http://www.pids.gw.ph/ACIAR. Accessed on January 7th2010.

_____. Mulch. http://hgic.clemson.edu/factsheets/HGIC1604.htm Accessed on January 10 th 2010

_____All about mulch. http://www.savvygardener.com.features/mulch.html

_____.Mulches. http://www.ipm.ucdavis.edu/PMG/GARDEN/ENVIRON/mulches.html Accessed on January 10th 2010

Aqil, M., I.U. Firmansyah, & M. Akil. 2007. Pengelolaan Air Tanaman Jagung. *Dalam* Jagung, Teknik Produksi dan Pengembangan. Badan Penelitian dan Pengembangan Pertanian, Pusat Penelitian dan Pengembangan Tanaman Pangan, 219 – 237.

Arifin, Z. 2005. Perbaikan Sistem Tanaman Dalam Budidaya Jagung di Lahan Tadah Hujan. Buletin Teknologi dan Informasi Pertanian. Balai Pengkajian Teknologi Pertanian (BPTP) Jatim, 8: 23-33.

Bahrudin. 2003. *Modifikasi lingkungan untuk meningkatkan hasil bawang merah (Allium ascalonicum, L.) varietas Palu.* (Disertasi S-3,Universitas Brawijaya, Malang).

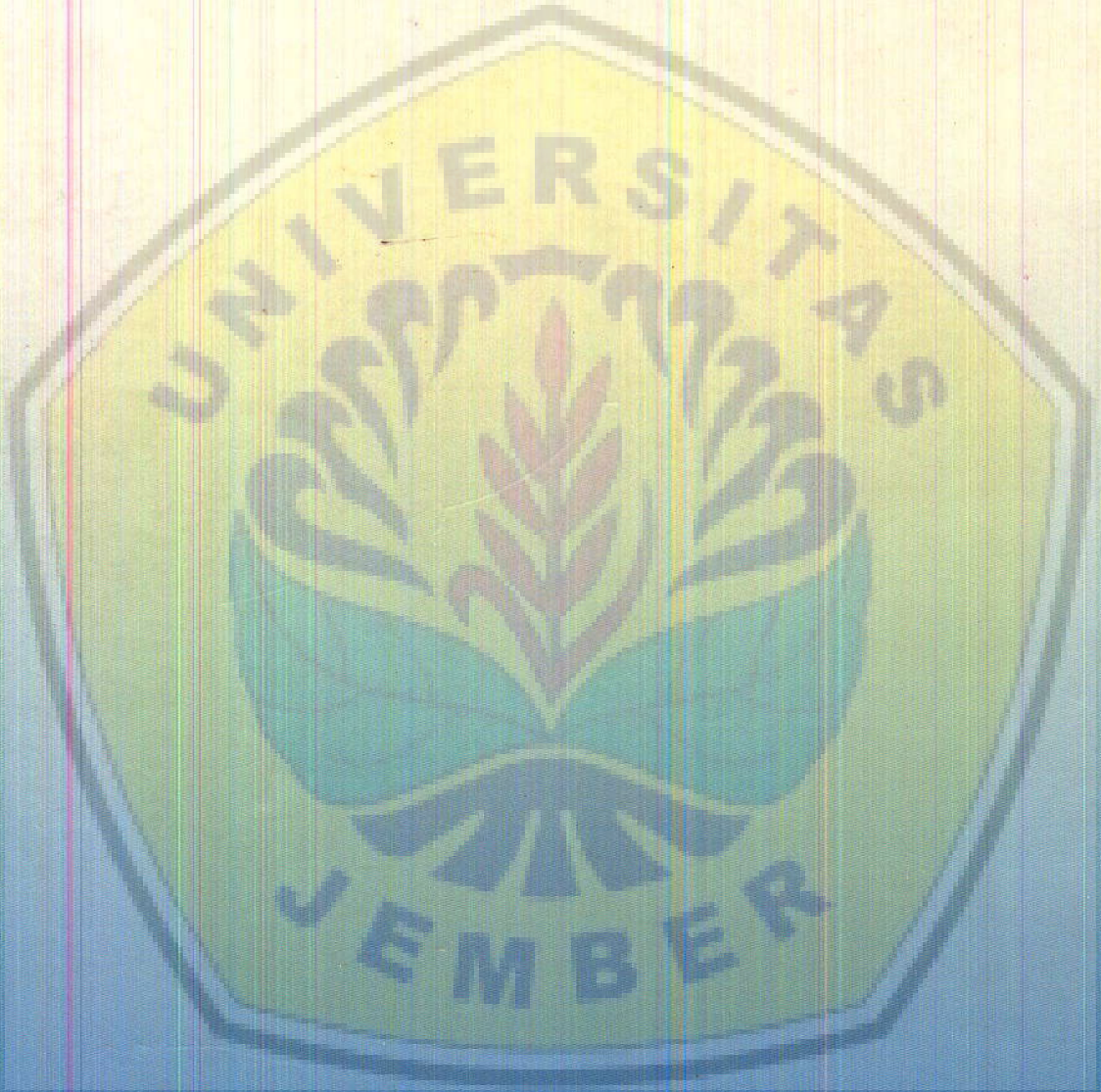
Kasijadi, F., M.I. Wahab, H. Suseno dan W. Astuti. 2000. Pengkajian Usaha Pertanian (SUP) Jagung di Lahan Kering. Prosiding Seminar Hasil Penelitian/Pengkajian Teknologi Pertanian Mendukung Ketahanan Pangan Berwawasan Agribisnis. Malang, 8 – 9 Agustus 2000: 127- 138.

Kasryno, F. E. Pasandaran, Suyamto dan M.O. Adnyana. 2007. Gambaran Umum Ekonomi Jagung Indonesia. *Dalam* Jagung, Teknik Produksi dan Pengembangan. Badan Penelitian dan Pengembangan Pertanian, Pusat Penelitian dan Pengembangan Tanaman Pangan. pp. 474 – 497.

Pikukuh, B.; A.S. Roesmarkam dan M.I. Wahab. 2000. Uji Adaptasi calon Varietas Unggul Jagung Spesifik Lokasi Lahan Kering. Prosiding seminar hasil penelitian /Pengkajian Teknologi Pertanian Mendukung Ketahanan Pangan Berwawasan Agribisnis. Malang, 8 – 9 Agustus 2000. hal 139 -143.

Purnomo dan R. Hartono. 2002. Bertanam Jagung Unggul. Penebar Swadaya. pp 67.

William, D.J. 1997. Organic mulch. http://www.ag.uiuc.edu/~vista/html_publ/mulch/MULCH.html. Accesed on Feruary 8th 2010.



ISNAR-C2FS 2011