ABSTRACT

PURWONO. Water Use Efficiency on Upland Sugar Cane. Supervised by DIDY SOPANDIE as the chairman, SRI SETYATI HARJADI and BUDI MULYANTO as the member of advisory committee.

Low Indonesian sugar production is mainly due to low productivity and low sugar yield. The shift of sugarcane crop acreage from low land to upland was the major factor of low productivity. Cultivation of sugarcane in uplands faced many constraints, namely low availability of soil water, low soil nutrient and unavailability of appropriate varieties. Cane cultivation in upland is commonly done at the beginning of the wet season (in November) in order to avoid the plant from water stress at the beginning of growth period. This causes the sugarcane age of only 7 months and have not reach maturity at harvest time in June which leads to lower sugarcane productivity.

Shifting planting season is an alternative that can be done to obtain plants with sufficient maturity at the harvest time. However, the consequences of shifting the planting season is that the planting occurred on dry season and which means that watering is needed. The limited availability of water demands efficiency in water usage. The application of organic matter as filter cake compost is expected to reduce the frequency of irrigation.

This aims of this study are (1) to study the effect of water supply on performance of several varieties of sugarcane, (2) to study the effect of filter cake compost on nutrient uptake by sugarcane at various irrigation levels, (3) to analyze the efficiency of water usage in connection with the provision of filter cake compost in some varieties of sugarcane, and (4) to develop recommendation of water supply efficiency in the field with the addition of filter cake compost. The study was conducted in three stages of the experiment, which were the performance of several varieties under water stress, the effect of filter cake compost and irrigation on plant nutrient uptake, and the application of filter cake compost and frequency of irrigation on upland sugar cane productivity.

The sugarcane varieties used in the experiments of performance varieties under different moisture content were PS 851, PS 864, PS 862, PS 921, PS 951, PS 91-787 and BL. After 3 months observation, it appears that water stress began significantly affected plant growth at 50% of field capacity (FC). The results showed that seven varieties were able to grow well under soil water content up to 75% FC. Based on Drought Tolerance Index, varieties BL and PS 864 has DTI values close to tolerant, while others were considered as moderate tolerant. Although the DTI value of PS 921 was only classified as moderately tolerant, it has the highest biomass in all of the soil water content treatments. It shows that PS 921 has the highest potential among the other varieties as variety of sugarcane suitable for upland planting.
To study the effect of filter cake compost and water supply on the nutrient uptake of sugarcane, the variety PS 921 was used. The dose of filter cake compost were 0, 5, 10, 15, and 20 tons per hectare and the soil water content were 100%, 75% and 50% FC, respectively. The results of this experiments show that the uptake of P by sugarcane was influenced by soil water content, whereas filter cake compost was not significantly influenced. The results of nutrient analysis showed residual P was greater in soil with low water content but it has smaller dry weight. The effect of filter cake compost was not significant in this experiment. Sugarcane plants under low water level condition have a smaller shoot-root ratio. This indicates that sugarcane plants overcome water shortage conditions by increasing root growth as their effort to fulfill the need of water. This has caused proline content not to increase in plans under water stress conditions.

Field experiments using two varieties of PS 862 and PS 864 showed that addition of filter cake compost on Regosol soil was able to reduce the frequency of irrigation from once a week to 2 weeks without lowering the yield. The amount of water needed at each watering was 100 m$^3$. The amount of water needed per month was 20% of crop evapotranspiration ($ET_p$) amount. The highest yield of plants obtained was on plants treated with 5 tons filter cake compost with two weeks irrigation frequency. The relationship between the dose of filter cake compost with crystalline sugar, showed that the highest yield, 7.62 tons, achieved at dose of 3 tons filter cake compost per hectare. With a furrow area 36% of the total area, so if an application made to the entire surface of the ground with the applicator, the doses is equivalent to 8 tons.

The results showed that the productivity of sugar could be increased if the plant has sufficient maturity at harvested. This could be achieved if planting is shifted 2 months earlier before the rainy season. To ensure the early growth of plants, watering should be given. With the application of filter cake compost irrigation could be given every 2 weeks. If water conditions in the field is sufficient, recommendation of varieties are those that have high yield potential which are varieties similar to PS 921 or PS 862. Under lower soil water content it was recommended to use varieties similar to PS 864.

**Keyword**: filter cake compost, variety, soil water content, rendement (commercial sugar content)