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GROWTH AND YIELD RESPONSE OF 457 PURPLE SWEET POTATO (*Ipomoea batatas*) TO DIFFERENT RATES OF POTASSIUM FERTILIZER

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By

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DEPARTMENT OF CROP SCIENCE
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CERTIFICATION

This project report entitled "Growth and Yield Response of 457 Purple Sweet Potato (*Ipomoea batatas*) to Different Rates of Potassium Fertilizer" prepared by Wan Nur Diyana Bt Wan Abd Aziz submitted to the Faculty of Agriculture in fulfilment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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ABSTRACT

A study was conducted to determine the growth and yield response of 457 purple sweet potato (*Ipomoea batatas*) to different rates of potassium fertilizer. The objectives of the study were (i) to identify the optimum rate of potassium fertilizer for maximum growth of 457 purple sweet potato and (ii) to evaluate the yield performance of 457 purple sweet potato grown with different rates of potassium.

The experiment was carried out at Field 2, Universiti Putra Malaysia Serdang, Selangor. The vines used as planting materials of 457 purple sweet potato were collected from Felda Raja Alias, Jempol, Negeri Sembilan and there were propogated at Field 2 for two months before been planted in the experimental plot. Stem cuttings of 25 cm in length were used. In total there were 460 stem cuttings grown in 20 experimental plots.

The application of potassium fertilizer was divided into 3 stages: at the 3rd, 5th and 8th week after sowing. Muriate of Potash (MOP) was the source of potassium and was applied with five different rates: 0 (control), 80, 120, 160 and 200 kg ha^{-1}. Each treatment had four replications.

Data on maximum leaf number, maximum total dry weight, total fresh weight of tubers, leaves and vines, total dry weight of tubers, leaves and vines, maximum leaf area index (LAI) were measured in this study. The design of the experiment was a Randomized Complete Block Design (RCBD) and data obtained were analyzed using Analysis of Variance (ANOVA) with the Statistical Analysis System (SAS) software.

The application of different rates of potassium fertilizer did not show any significant effect on the growth and yield of 457 purple sweet potato. Since there was no significant difference found, the application of the optimum rate of potassium fertilizer for growth and yield of 457 purple sweet potato cannot be recommended.

ABSTRAK

Satu kajian telah dijalankan untuk mengenalpasti tindakbalas kadar baja kalium yang berbeza terhadap pertumbuhan dan hasil ubi keledek ungu 457 (*Ipomoea batatas*). Objektif kajian adalah (i) untuk mengenalpasti kadar baja yang optimum bagi pertumbuhan maksimum ubi keledek ungu 457 dan (ii) untuk menilai prestasi hasil ubi keledek ungu 457 yang ditanam menggunakan kadar baja kalium yang berbeza.

Kajian ini telah dijalankan di Ladang 2, Universiti Putra Malaysia, Serdang. Bahan tanaman di ambil daripada Felda Raja Alias, Jempol, Negeri Sembilan dan telah dibiakkan di Ladang 2 selama dua bulan sebelum ditanam di plot kajian. Keratan batang berukuran 25 cm digunakan. Jumlah keseluruhan keratan batang adalah sebanyak 460 batang yang ditanam di dalam 20 plot eksperimen.

Penggunaan baja kalium terbahagi kepada 3 peringkat: minggu ketiga, kelima dan kelapan selepas tanam. Baja Muriate of Potash (MOP) sebagai sumber kalium telah digunakan dengan 5 kadar yang berbeza iaitu: 0 (kawalan), 80, 120, 160 and 200 kg ha^{-1}. Setiap rawatan ini mempunyai 4 replikasi.

Data yang diukur dalam kajian ini adalah bilangan maksimum daun, jumlah maksimun berat kering, jumlah berat basah ubi, daun dan batang, jumlah berat kering ubi, daun dan batang dan index luas permukaan daun maksimum (LAI). Rekabentuk kajian adalah Rekabentuk Blok Rawak Lengkap dan data dianalisa menggunakan ANOVA di dalam perisian Sistem Analisis Statistik (SAS).

Berdasarkan hasil kajian, penggunaan baja kalium yang berbeza tidak menunjukkan perbezaan bererti ke atas pertumbuhan dan hasil ubi keledek ungu 457. Oleh kerana tiada perbezaan bererti yang wujud di dalam kajian ini, penggunaan baja kalium yang optimum untuk tumbesaran dan hasil ubi keledek ungu 457 tidak dapat dicadangkan.

CHAPTER 1

INTRODUCTION

According to Yuan et al. (2014), agricultural activity all over the world has been increasing due to the fast growing of world population. In order to feed the people, the agricultural sector is modernized to increase yield of food crops by enhancing soil fertility by adding fertilizer. Agriculture is the main element in human development by which producing food for human consumption (Wikipedia, 2014). Malaysia for example, needs agriculture as one of the main sectors to enhance growth of social and economy aspects. Sweet potato is one of the tuberous crops planted in Malaysia. Planting of sweet potato in Malaysia has being commercialized especially in rubber and oil palm re-planting areas as a cash crop. In 2006, 1,991 ha of land were planted with this crop with the production of 28,445 metric tons. However, only 1,320 ha of land planted with the production of 18,810 metric tons in 2009 (Hosnan, 2010).

Sweet potato *(Ipomoea batatas*) is a tuberous root crop (Nedunchezhiyan et al., 2011). Sweet potato is a member of bindweed or morning glory. Sweet potato is often planted annually due to the minimum expenditures though it is a perennial plant and need high maintenance especially during the first stage of planting (Unctad, 2012). It is widely grown in tropics and sub-tropics around the world and grown by the native people in tropical America. This remarkable crop is highly adaptable to extreme conditions such as hot climatic condition, infertile soils, and shows some intolerance to pests and diseases.

Sweet potato ranks fifth after rice, wheat, maize and cassava in the most crucial food crop (Som, 2007). It ranks third after banana and cassava in the most crucial agricultural products in terms of quantity (Unctad, 2012). World total production of sweet potato from 115 countries was 108,274,685 metric tons in 2010. China, with 82,474,410 metric tons from the total output is the biggest producer of sweet potato followed by Indonesia with 2,083,623 metric tons (Unctad, 2012).

In Malaysia, there are 10 varieties of sweet potato cultivated such as Gendut, Jalomas, Cina, Banting and Telong. The differences among sweet potato varieties are mainly in the colour, shape, taste, uses, growth period and yield.

Sweet potato requires high amount of potassium (K) as the natural potassium in the soil similar with other crops such as sugarcane, Irish potato and cassava because potassium is commonly removed by leaves, vines and stems from the soil. Potassium is the most important nutrient for the growth and yield of sweet potato as it influences the number, size, quality and weight of the tubers (Uwah et al., 2013). Low amount of potassium causes the yield to be significantly reduced (Uwah et al., 2013). As the carbohydrates are the major storage compartment in sweet potato, potassium functions in stimulating the enzymes activity in photosynthesis, carbohydrate and protein formation and assist in the translocation of carbohydrates from leaves to roots and tubers (Trehan et al., 2009).

George et al. (2002) reported that potassium enhances photosynthetic activity as well as sugar translocation and activity of enzyme. Since the availability of the nutrient in the soil is inadequate, fertilizers must be added. Basically, there are two parameters in terms of economic reaction for crop to fertilizer which are yield and quality (George et al., 2002). Finding by Bourke (1985) revealed that usage of 375 kg K_2O ha^{-1} boosted yield, number of tuber, fresh weight of tuber and dry weight of plant, leaf area index (LAI) and harvest index (HI).

The recommendation rate to grow sweet potato for N is 35-36 kg ha^{-1}, for P_2O_5 is 50-100 kg ha^{-1}, and for K_2O is 80-170 kg ha^{-1} (Wichmann, 1992). For instance, in China, 150-300 kg of K_2O has been used for sweet potato planting (Jian-wei et al., 2001) while in India, 120 – 160 kg K_2O ha^{-1} is needed (Trehan et al., 2009) as minimum requirement for optimum plant growth.

Potassium is one of the most important factors affecting the growth and yield of *Ipomoea batatas*. The application rate from 80 – 200 kg K_2O ha^{-1} is identified suitable for the growth of sweet potato. Furthermore, Bourke (1985) proved that N gave more effect on growth and yield of sweet potato compared to potassium. Moreover, potassium inhibited physiological activities such as decreased content of protein, percent of dry matter and firmness, enhanced crude fiber and had no effects on carotenoid and roots splitting (Constantin et al., 1977). Identification of optimum rate of potassium is important to obtain high yield. Thus, the study on evaluation of different rates of potassium was conducted with the following objectives: 1) To identify the optimum rate of potassium fertilizer for maximum growth of 457 purple sweet potato and 2) To evaluate the yield

performance of 457 purple sweet potato grown with application of different rates of potassium.

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