

**THE EFFECT OF FERTILIZER APPLICATION AND LEFTOVER  
RESIDUE ON GROWTH AND YIELD OF FORAGE SORGHUM  
(*Sorghum vulgare*) PLANTED IN DOUBLE AVENUE OIL PALM  
PLANTING SYSTEM.**

**NORKASPI KHASIM**

**Thesis Submitted in Fulfillment of the Requirement for the Degree of  
Master of Science in the Faculty of Agrotechnology and Food Science  
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## **DEDICATION**

This dissertation is dedicated to:

My beloved parents, Mrs. Hasnah bt. Zakaria and Mr. Abdullah b. Mohd Yusof (stepfather). My lovely wife; Khairani Nasriyah bt. Mohamad. My lovely daughters and sons; Fatin Noraina, Siti Mariam, Nur Atiqah, Nur Alia, Nur Fatihah, Noradli and Noraidid.

Without their continual love and support, the completion of this dissertation would not have been possible

Abstract of thesis presented to the senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the Master of Science.

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**Faculty : Agrotechnology and Food Science**

The main objectives of this research are to understanding the residual decomposition process and the availability of nutrient in the soil and uptake by forage sorghum plants in supporting the growth of oil palm. Experiments were set up to investigate the effect of forage sorghum residue with and addition some inorganic fertilizer (500 kg ha<sup>-1</sup> of NPK 15:15:15, 98 kg ha<sup>-1</sup> of Triple Super phosphate, 75 kg ha<sup>-1</sup> of Muriate of Potash and 357 kg ha<sup>-1</sup> of Urea). Four treatments were tested: R1F1 (the plots with forage sorghum residue decomposing and additional inorganic fertilizer), R1F2 (the plots with forage sorghum residue decomposing and without fertilizer programme), R2F1 (the plots without forage sorghum residue decomposing and with fertilizer programme) and R2F2 (the plot without forage sorghum residue decomposing and without fertilizer programme) as a control.

The results obtained in this study showed that there was no significant difference on dry weight of leaves and total dry weight per clump of forage sorghum for the treatment with and without inorganic application fertilizer. Similarly, the addition of inorganic fertilizer did not affect the dry matter yield of forage sorghum. However, for better plant growth, inorganic fertilizer is still essential. The treatment of R1F2 showed the highest fresh and dry weight of root per clump with an average of 75.7g and 33.0 g respectively. It is noted that the application of organic residue will enhance the growth performance and number of forage sorghum roots in the soil. The result in R2F1 showed that sorghum can be used as fodder for the livestock industry in Malaysia and the nutrient losses will be replaced by inorganic fertilizer application.

The amount of N, Mg and Ca estimated were high in the treatment R1F1 with an amount of 313.18 kg ha<sup>-1</sup>, 54.26 kg ha<sup>-1</sup> and 94.06 kg ha<sup>-1</sup> respectively. However, the amount of P and K were highly estimated in R1F2 with an amount of 81.48 kg ha<sup>-1</sup> and 896.53 kg ha<sup>-1</sup>. Total fertilizer equivalent for AS and Kieserite were higher in R1F1 with an amount of 1,491.33 kg ha<sup>-1</sup> and 200.96 kg ha<sup>-1</sup> and the monetary value was RM1,372.02 and RM180.86 respectively. Total fertilizer equivalent for CIRP and MOP were observed high in R1F2 with the amount of 254.63 kg ha<sup>-1</sup> and 1,494.22 kg ha<sup>-1</sup> and monetary value was RM168.06 and RM2,689.60. The total monetary value for every treatment was shown higher in R1F2 with the value of RM4,384.26. It was followed by the treatment of R1F1, R2F1 and R2F2 with the value of RM4,164.23, RM3,915.69 and RM2,888.09 respectively. The results indicated that the decomposition of forage sorghum residue contributes and influences the available nutrient in the soil. On the other hand, it also influences the concentration of nutrient in the forage sorghum started from 1<sup>st</sup> to 4<sup>th</sup> harvest.

Abtrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Master Sains.

**KESAN APLIKASI BAJA DAN SISA PEREPUTAN YANG DITINGGALKAN  
TERHADAP PERTUMBUHAN DAN HASIL SORGHUM FORAJ (*Sorghum vulgare*)  
DITANAM DALAM SAWIT SISTEM DUA BARIS KEMBAR.**

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Objektif utama kajian ini adalah untuk meningkatkan kefahaman berkaitan proses pereputan sisa tanaman, ketersediaan nutrien di dalam tanah, pengambilan nutrient oleh tanaman sorghum foraj serta keupayaannya dalam membantu meningkatkan pertumbuhan sawit. Kajian dijalankan untuk melihat sejauh mana amalan pembajaan organik dari pereputan sisa tanaman sorghum dan penggunaan sebahagian baja sebatian kimia (NPK 15:15:15, 500 kg/ha; TSP, 98 kg/ha; MOP, 75 kg/ha dan Urea 357 kg/ha) akan meningkatkan kesuburan tanah serta ketersediaan nutrien dalam tanah. Sebanyak 4 rawatan telah diuji, iaitu R1F1 (plot tanaman sorghum foraj yang dirawat sisa pereputan sorghum dan penggunaan baja sebatian kimia): Rawatan R1F2 (plot tanaman sorghum foraj yang dirawat dengan sisa pereputan sorghum tanpa penggunaan baja sebatian kimia): Rawatan R2F1 (plot sorghum foraj yang tiada rawatan sisa pereputan sorghum tetapi diberi rawatan baja sebatian kimia) dan Rawatan R2F2 sebagai plot kawalan.

Keputusan dari kajian ini menunjukkan tidak terdapat kesan yang bererti ke atas berat kering daun dan berat kering serumpun sorghum foraj bagi rawatan baja sebatian kimia berbanding dengan tanpa rawatan baja sebatian kimia. Ini menunjukkan penggunaan baja sebatian tidak memberikan kesan kepada berat kering sorghum. Walaubagaimanapun bagi pertumbuhan yang lebih baik pembajaan kimia masih diperlukan. Rawatan R1F1 menunjukkan purata berat segar akar serumpun tertinggi, 75.67g dan purata berat kering akar tertinggi, 33.0g. Ini menunjukkan penggunaan baja organik telah meningkat prestasi pertumbuhan dan bilangan akar sorghum dalam tanah. Keputusan rawatan R2F1 pula menunjukkan sorghum foraj boleh digunakan sebagai foraj dalam industri ternakan di Malaysia. Nutrien yang hilang akan diganti dengan penggunaan baja sebatian kimia semasa program penanaman.

Anggaran kandungan N, Mg dan Ca tertinggi dalam rawatan R1F1 berjumlah masing-masing 313.18 kg/ha, 54.26 kg/ha dan 94.06 kg/ha. Walaubagaimanapun, anggaran kandungan P dan K tertinggi dalam R1F2 berjumlah masing-masing 81.48 kg/ha dan 896.53 kg/ha. Jumlah baja Aluminium Sulphate (AS) dan Kieserite yang setara tertinggi dalam R1F1 berjumlah 1,491.33 kg/ha dan 200.96 kg/ha dengan nilai masing-masing sebanyak RM1,372.02 dan RM180.86. Jumlah keperluan baja Christmas Island Rock Phosphate (CIRP) dan Muriate of Potash (MOP) yang setara tertinggi dalam R1F2 masing-masing adalah 254.63 kg/ha dan 1,494.22 kg/ha dengan nilai sebanyak RM168.06 dan RM2,689.60. Jumlah nilai kewangan tertinggi adalah dalam R1F2, iaitu sebanyak RM4,384.26 dan diikuti oleh R1F1(RM4,164.23), R2F1(RM3,915.69) dan R2F2(RM2,888.09). Keputusan kajian menunjukkan pereputan sisa sorghum mempengaruhi ketersediaan nutrien dalam tanah. Secara tidak langsung juga mempengaruhi konsentrasi nutrien dalam tanaman sorghum mulai tuaian 1 hingga ke-4.