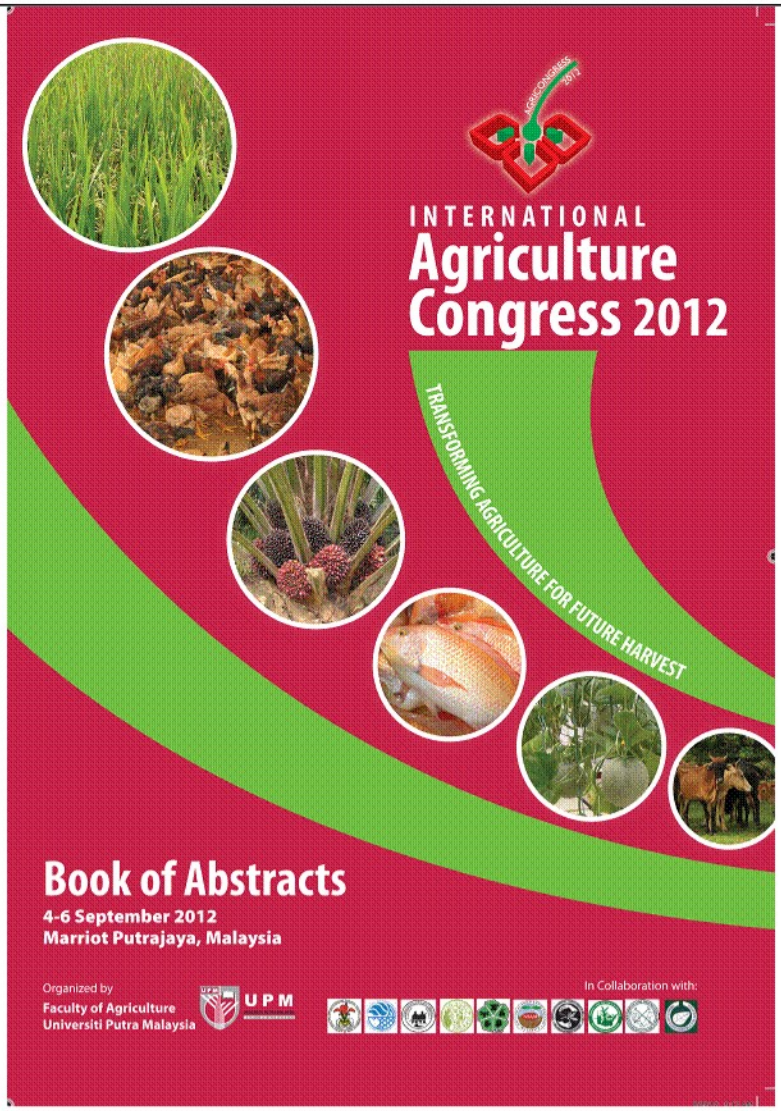

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EFFECTS OF DIFFERENT FERTILIZERS ON SECOND-SEASON NO-TILL SUCCEEDING TILLED SWEET CORN (*Zea mays*)

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INTRODUCTION

Zero tillage or no-tillage system is an essential feature of conservation agriculture. The system is based on the use of crop residues or mulch as a surface cover. In no-tillage farming, the seeds are directly sown into the untilled soil which has retained the previous crop residues which remain largely undisturbed at the soil surface as mulch. Studies employing efficient methods to reduce nutrient applications at the same time increasing or maintaining crop yield, reducing nutrient losses and improving nutrient use efficiency are imperative.

The continuous implementation of no-till farming is in agreement with the requirements of sustainable agricultural production. According to Derpsch (2010), no-till provides the benefits of efficient erosion control, sequestration of atmospheric carbon in the soil and increased biological activity in the soil, for improved water conservation and to higher economic returns over time. Numerous studies have reported yield increases with adoption of no-till farming because of improved soil structure, and surface residue cover enhance water infiltration, root growth and/or reduce evaporative water losses from the soil (Tarkalson *et al.,* 2006 and Diaz-Zorita *et al.,* 2004). In contrast, other studies have also shown decreased crop yields with no-till practice (Drury *et al.,* 2003).

In Malaysia, most corn growers practice conventional tillage as opposed to no-till practice largely due to constraints related to weed control, labor, and runoff losses of nutrient. In addition, rising fuel and labor costs in crop production under conventional farming systems may hamper efforts to optimize yields and profits. No-till practice could be an alternative to cut costs of production and recycle nutrients in corn production fields. However, in Malaysia, very little information currently exist on using no-till practice for corn production. This study was to evaluate the effects of fertilizers and their residuals on previous tilled and subsequent no-till corn systems.

METHODOLOGY

Field investigations consisting of two experiments were conducted in 2012 at the experimental field of University Agriculture Park in Puchong (02°N 59.035', 101°E 38.913'). The soil is of Serdang series soil (Typic Kandiudult). During the first growing season, the experimental field was cleared, ploughed and harrowed (conventional tillage), while in the succeeding season, no-till was practiced by placing the corn residues on the surface between the planting rows prior. Each plot measured 8 x 3.75 m (for tilled field) and 4 x 3.75 m for each of fertilized and unfertilized plots (for the no-tilled field). Control-released fertilizers (Kamila), a conventional fertilizer (mixture) and control (no fertilizer) were applied to an established corn plots in five different treatments laid out in randomized complete block design with six replications (Table 1). Each of the treatments (except control) contained standardized rates of nitrogen, phosphorous and potassium (N = 120 kg/ha, P_2O_5 = 60 kg/ha and K_2O = 240 kg/ha). The treatments were applied in one dosage 2 weeks after emergence**.**

Table 1. Fertilizer treatments, application techniques and description of experimental plots

Fertilizer Treatments	Grade	Application Techniques
Control	-	No Fertilizer
Mixture Fertilizer	10-6-20-2	Surface applied
Kamila Nugget (KN)	10-6-20-2	Surface applied
Kamila Nugget (KN)	10-6-20-2	Incorporated
Kamila Granule (KG)	10-6-20-2	Surface applied

Mentioned trade name does not constitute to the endorsement of the product

Fresh cob weight data was recorded at 70 days after planting. Analysis of variance and treatment means comparisons were performed using the procedures from Statistical Analysis System (SAS) computer software (Version 9.2).

RESULTS AND DISCUSSION

The results showed an increase in soil bulk density from the tilled (1.29g/cm^3) to the no-tilled (1.35g/cm^3) practices. This slight change may lead to changes to the soil-plant environment, particularly with respect to root proliferation. Plant biomass differed significantly between some treatments throughout the plants' growth stages

for both tilled and no-till practices (data not shown). Application of Kamila granule (KG) for the tilled practice appeared to have increased the plant dry weight in contrast with the dosage of mixture fertilizers and control treatments by 33% and 64%, respectively. This may suggest that nutrients released from the conventional fertilizers (mixture) may be easily leached or lost through runoff, since the fertilizer is released faster. Previous observation by Warren *et al.* (2001) revealed that a faster nutrient release rate, if not subsequently absorbed by the plant, could result in higher nutrient losses in the effluent.

Table 2. Comparison of cob yield between first and second season of the corn experiment

	Fresh cob weight (kg/m^2)		
		2nd Season (No-tilled practice)	
Treatments	**1st Season (Tilled practice)**	**Unfertilized plots**	**Fertilized plots**
Control	1.16c	0.71c	0.75c
Mixture Fertilizer	2.04b	0.92b	1.44b
KN Surface	2.32ab	1.12ab	1.75a
KN Incorporated	2.40b	1.13ab	1.50b
KG Surface	2.65a	1.22a	1.88a

Comparison between means within column using DMRT (p=0.05)

The grain yield ranged from 1.16 to 2.65 kg/m^2 and 0.75 to 1.88 kg/m^2 for the tilled and no-tilled practices (Table 1). For the tilled practice, application of controlled release KG fertilizer culminated in 23% increase in fresh cob yield as opposed to mixture fertilizer and the decrease in plant cob yield for non-treated (Control) compared to KG treated plots was 56%. However, for the no-till system, KG dosage resulted in 60% and 23% higher cob yield as compared to control and mixture treatments, respectively. The results of cob yield of fertilizer residual effects (unfertilized plots) in the no-till practice ranged from 0.92 to 1.22 kg/m^2. For the no-till practice, the unfertilized (fertilizer residual effect) plots showed about 30% reduction in yield in contrast to fertilized plots. Tilled practice exhibited higher cob yield for all the treatments in contrast to the no-till practice, however the benefits of no-till practice in terms of improving soil structure and controlling erosion may be of considerable importance.

CONCLUSION

The response of corn to fertilizer dosage under tilled and no-tilled conditions varied greatly among treatments. The dominance of control released KG fertilizer in both vegetative growth and fresh cob yield in corn might have been influenced by nutrient release patterns of the fertilizer material. There was strong evidence of tilled system showing enhancement in overall sweet corn yield as compared to no-till practice. It is suggested that even though no-till farming may reduce yield, with a calculated risk of about 29% yield loss, a high improvement of the soil physical, chemical and microbial environment may be realized in the long run.

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