STUDY OF NPK UPTAKE AND GROUNDNUT YIELD IN BRIS SOIL AREA

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ABSTRACT

Intercropping systems have been considered as sustainable land-use since its can contribute in attributes characteristics of natural ecosystems especially those that have beneficial effects on soil properties. The objectives of this study need to assess the chemical composition (NPK) in the area of BRIS soil and groundnut planted in integration with Sesbania grandiflora tree. The use of organic fertilizers to increase soil fertility and reduce pollution to the environment is better than the use of chemical fertilizers as well as enhancing the crop yields in the depleted BRIS soil. A randomized completed block design with three different fertilizer treatment was used in carrying out the study which is Control, green manure and organic fertilizer treatment. Plant holes were manually dug with a hoe at the spacing 20 cm between plants. The Nitrogen uptake was determined using Kjeldahl method. The Phosphorus uptake was determined using UV spectrometer and Potassium uptake was determined using atomic absorption spectrophotometer. The plants analysis result shows that the green manure fertilizer treatment was highest at Nitrogen uptake while the organic fertilizer treatment was highest at Phosphorus and Potassium uptake. In term of soil analysis, the green manure fertilizer treatment was highest at Nitrogen and Phosphorus uptake while the organic fertilizer treatment was highest at Potassium uptake. In conclusion, the integration of leguminous crop and leguminous tree give the maximum yields. The accepting of eco-friendly intercropping systems as land improvement is the best choice to produce sustainable peanut production.

Key words: Nitrogen, Phosphorus, Potassium.

INTRODUCTION

Nutrient status is a hidden factor in plant development except when imbalance become so extreme that visual indications show up on the plant. Since the structural chemistry of plant tissue permits definite limits of plant nutrient concentration for tissue build up normal uptake of nutrients must therefore be within established interactive ratios for the plant (Uyovbisere & Lombin, 1991). Some of the factors with crop variety selection, available moisture, soil fertility, adaptation to the area, plant densities, crops densities, and presence of disease, pests and crops could have significant impact on the nutrient element composition of plant (Mukhtar A. A., *et al*., 2012). The enhancement of the mineral nutrition is the way to improve the production of groundnut, as it has very high nutrient condition and the recently released great yielding groundnut varieties remove still more nutrients from the soil (Murli *et al.*, 2017).

Groundnut (*Arachis hypogea*) is one of the world's most popular crops cultivated throughout the tropical and sub-tropical areas where annual rainfall in between 1000-1200 mm for optimum growth of the crop (John O. S., 2010). Groundnut has high economic and nutritional potential and is an important cash crop for farmers in poor condition of BRIS soil. Groundnut do well on deep, well drained sandy, sandy loam or loamy sand soils with pH ranging between 5.3- 6.5 (Farmer management Handbook, 2010). The groundnut plays an extremely important agronomic role in the traditional farming systems as a nitrogen fixer in harvest revolution (Ustimenko- Bakumovsky, 1993).

The objective of this trial was to assess the chemical composition (NPK) in the area of BRIS soil and groundnut planted in integration with *Sesbania grandiflora* tree. Available literature suggest that great yields of groundnut and sustainability in its production can be gained with better fertility management practices particularly with organic farming practices (Nagaraj *et al.* 2001). Therefore, from the integration and incorporation with *Sesbania grandiflora* in the agricultural system helps to enhance the BRIS soil structure, soil microbial activity and soil moisture management and which in term helps to stabilize the production and yield of the groundnuts crops.

MATERIALS AND METHOD

2.1 Site preparation.

The selected site was at Kampung Mujur, Bachok. The site area was 15 m x 22.5 m. Firstly, the soil was cultivated. After land preparation (ploughing and harrowing), the site was then laid out to the required beds size of 9m × 0.8 m each. There were 3 beds for one treatment fertilizer.

2.2 Integrated planting.

The experimental design was a randomized completed block with three treatment of fertilizer consisted of control treatment, green manure fertilizer treatment, and organic fertilizer treatment. There were eleven plots in total. Each block divided into six and five plots representing three plots of fertilizer treatment and another plots was intercropping plots. Plots size was 9 m × 0.8 m each. Intercropping plots had an average of 10 trees of *Sesbania grandiflora* per plot. Plant holes were manually dug with a hoe at the spacing 20 cm between plants. Two to three seeds of groundnut were planted per hole on a depth 0- 2 cm.

2.3 Plants analysis.

Air dried the root until it is dry before put them in an oven and oven dried them until it is completely dried at 50 – 70 ˚C. Then, weighted the groundnut plant parts in term of dry weight and record their reading. The dry weight reading is essential for calculating the plant nutrients uptake. Next, the samples was blend using blender and keep in sealed zipper bags. The total cations such as K was determined using AAS. Phosphorus was determined using UV spectrophotometer after blue colour development. Nitrogen was determined using Kjeldahl method.

2.4 Soil analysis.

Soil sample were collected randomly in each row at the depth 0-20 cm by using Auger. The samples had been air-dried at 60 ˚c for 24 hours in the laboratory. The determination of nitrogen was proposed by Johan Kjeldahl in 1883. The value of phosphorus concentration was determined using UV spectrophotometer. Soil cations (mainly Ca, Mg, K) were held in exchangeable form on the surface of the soil particles, those that can be exchanged by a cation of an added salt. These value are very much dependence on chemical and mineralogical make-up of the soil. K, Ca and Mg were determined using atomic absorption spectrophotometer (AAS)

2.5 Data analysis.

The statistical analysis of the data was performed by the analysis of variance method (ANOVA) and Pearson Correlation using a statistical package program SPSS and differences of mean among treatment were determined by least significant differences. Result were considered significant at $P \leq 0.05$.

RESULT AND DISCUSSION

3.1 Plants analysis

Figure 1: The graph of the N, P, and K, content of leaves.

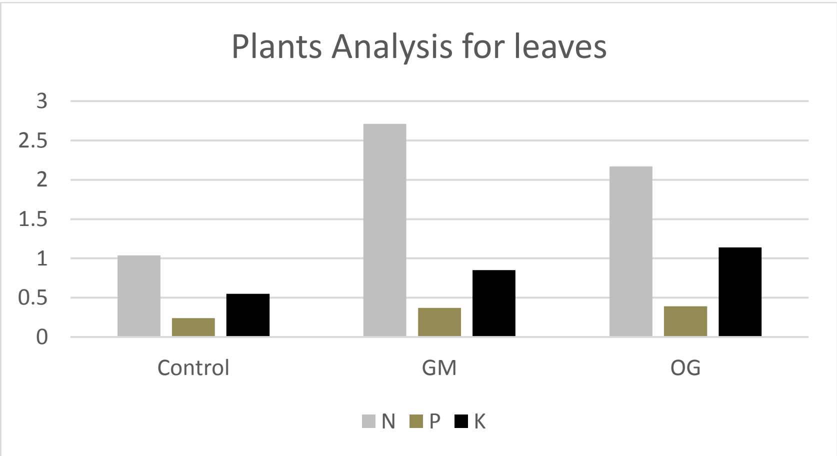
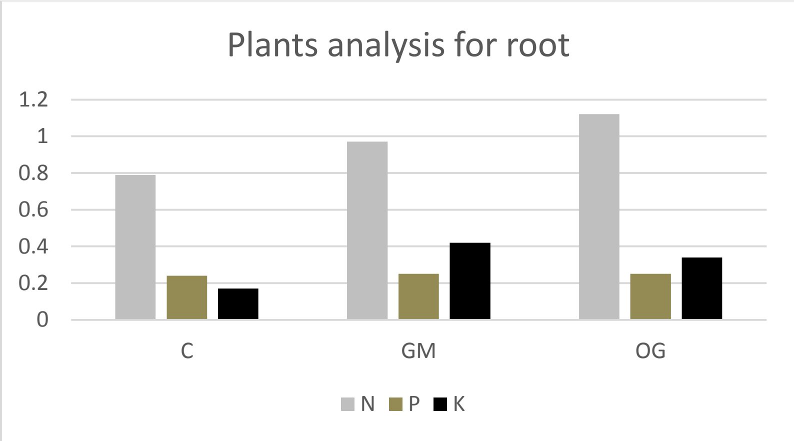


Figure 1 shows the graph of the Nitrogen, Phosphorus and Potassium content of the groundnut leaves at the field area with three different fertilizer. From the graph, the N content is higher at groundnut plants in green manure fertilizer treatment was 2.71 %, the Phosphorus and potassium content was higher at organic fertilizer treatment was 0.39 % and 1.14 % respectively. This is because the organic fertilizer suitable for groundnut production and improve soil fertility without leaving any residual effects in the soil and plants. According to Kamara E. G. *et al.*, (2011), the requirement of phosphorus in nodulating legumes is higher compared to non nodulating crops. Potassium increases crop production and improves quality. It is required for a few plant development forms. The previous study reported that in some plants, leaf blades reorient towards light sources to increase light interception or away to avoid damage by excess light, essentially helping to control the rate of photosynthesis. Moreover, Potassium is known for its ability to increase yield and improve quality. It also plays an essential role in photosynthesis and pod development in groundnut (Iman *et al*., 2014).

Figure 2: The graph of the N, P, and K content of root.



Nitrogen content inside the root is higher at organic fertilizer treatment was 1.12 % as shown in Figure 2, besides, the Phosphorus content at green manure and organic fertilizer was same 0.25 % and the Potassium content is higher at green manure fertilizer that was 0.42%. This is because the increasing in nitrogen as found in green manure has its effect on the vegetative improvement of crops and ensures healthy and vigorous growth. In addition, suitable plant nutrition also a good strategy to improve water use efficiency and productivity in groundnut plants. This is because a limited water supply inhibits the photosynthesis of groundnut plants, cause changes of chlorophyll content and components and damage to photosynthesis tool (Mukhtar A. A. *et al*., 2012).

In comparison between the N, P, K content at leaves and root in figure 1 and 2, the percentage of N, P, K uptake in the organic fertilizer was highest at root while for green manure fertilizer was highest at leaves. This is because the root was absorbed the nutrient inside the animal manure and supported by the integration of *Sesbania grandiflora* that the root of this plants already rich in N fixation. On the other hand, the green manure that made from the leaves of *Sesbania* is same family with groundnut. It is some advantages for groundnut to obtain more nutrients from the legume family.

3.2 *Soil analysis*

Table 1: Combined Pearson's correlation between soil and plant properties.

	NL	NR	PL	PR	KL	KR
NL	1					
NR	.932**	1				
PL	-.827**	-.914**	1			
PR	-.827**	-.914**	1.000**	1		
KL	.930**	.981**	-.845**	-.845**	1	
KR	.386	.298	-.157	-.157	.326	1
**, significant at 0.01 level,; NL, Nitrogen leaves; NR, Nitrogen root; PL, Phosphorus leaves; PR, Phosphorus root; KL, Potassium leaves; KR, Potassium root.						

Combine Pearson's correlation analysis of soil and plants nutrients parameter as shown in Table 1 showed that the leaf and root nitrogen had positively higher significant relationship with leaf and root Phosphorus. Root Potassium exhibited negative and non-significant correlation with leaf and root Nitrogen and leaf and root Phosphorus. Similarly, root Potassium was negatively correlated with leaf Nitrogen (r=.386), root Nitrogen (r=.298), leaf Phosphorus (r=-.157), root Phosphorus (r=-.157) and leaf Potassium (r=.326). Significant and positive relationship existed between leaf and root Phosphorus with root nitrogen (r=.914), leaf Potassium (r=.845). From the result above, the correlation relationship between soil and plants was high due to the legume with root nodules, it can synthesize atmospheric nitrogen and improve soil fertility. Groundnut also plays an extremely significant agronomic role in alley cropping system as a nitrogen fixer in crop rotation (John O.S, 2010). Other than that, most of the result shows the significant different among Nitrogen uptake since Nitrogen the most important nutrient in plants, plays a key role in different cellular and physiological processes including osmotic adjustment, energy transfer, detoxification of reactive oxygen species, protein synthesis, stomata regulation, phloem transport, an important indicator of salt tolerance in plants (Naveed *et al*., 2019).

CONCLUSION

In summary, the integration of leguminous crop and leguminous tree give the maximum yields. The green manure fertilizer treatment shows the good result since the green manure were made from the legume tree and the amount of fertilizer applied is enough with the size of that area. On the other hand, the groundnut as legume crop have high potential to fix the atmospheric nitrogen, release in the soil high value organic matter and enable soil nutrient movement and water holding capacity. Therefore, the accepting of eco-friendly intercropping systems as land improvement is the best choice to produce sustainable peanut production. This is because this systems involve complex interactions and require good planning.

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