Varieties of *Arachis hypogaea* L. as influenced by Different Rates of Synthetic Chemical Nutrients

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Abstract. The study was conducted to determine the yield of varieties of peanut (*Arachis hypogaea* L.) as influenced by different rates of synthetic chemicals nutrients. NSIC Pn 08 and NSIC Pn 10 were used in the study. This study was conducted at the soil and climatic condition of Mindanao State University Buug Campus Field Laboratory, Zamboanga Sibugay, Philippines with an average temperature of 27 ^{0}C. The experiment was laid using Split – Plot in Randomized Complete Block Design (RCBD) with eight combined treatments and replicated three times. An area of 227.81 m^2 including alley ways was divided into 24 plots, each plot measured 1.5 m x 5 m. There were two factors used in the study, the varieties and rates of N_2, P_2O_5, K_2O fertilizer. Four seeds were planted per hill with the distance of 20 cm between hills and 70 cm between rows fifteen (15) days after planting. Thinning was done and leaving only one plant. There were two rows per plot and each plot has 46 hills with total of 1,104 plants. Different rates of complete fertilizer was drilled planting holes two days before planting at a rate of F_1 1.63 grams, F_2 2.44 grams, F_3 3.26 grams of complete fertilizer. The result revealed that the average weight of pods in grams per hill per plot per treatment showed that there was a significant difference among varieties. In addition, average number of pods, average number of seeds per hill per plot per treatment and total number of seeds per plot per treatment showed that there is no significant difference among the different varieties, different rates of complete fertilizer and on treatment combinations.

Keywords: Peanut, Split-Plot in Randomized Complete Block Design (RCBD), Varieties, NPK Fertilizers

Introduction

Peanut (*Arachis hypogaea*) or groundnut is an annual herbaceous plant of the fabaceae or legume family. It is known by many other local names such as earthnuts, groundnuts, goober peas, monkey nuts, pygmy nuts. Despite its name and appearance, the peanut is not a nut, but rather a legume (BPI, 2014). The genus *Arachis* is morphologically well defined and distinguished from other genera by having a peg and geocarpic reproductive growth. The genus *Arachis* has more than 70 wild species, of which only *Arachis hypogeae* is domesticated and commonly cultivated (Palomar, 1998).

Globally, peanut is the 13th most important food crop with 50% of it is used as raw materials for the manufacture of peanut oil, 37% for confectionery and 12% for seed purposes (BPI, 2014).

Asia has the largest area of groundnut cultivation in the world contributing to 67% of the total production in 2007. India holds the largest acreage (6.7 million ha) followed by the China (4.7 million ha), Indonesia, Myanmar, Pakistan and Thailand. There has been an important increase in harvested area in Asia in the last two decades mainly in China, Hong Kong, Japan, Korea and Taiwan. More than 25% of the groundnut area harvested in the world is in India followed by the 20% in China. However, China is the largest producer of groundnut and accounts for 37% of world production, followed by India 22% (Prasad et al., 2009).

In the Philippines, peanut is considered one of the major field legumes grown by local farmers. However, its production has been low and erratic with national average yield ranging

only from 800 to 1000 kilograms per hectare. On the other hand, peanut production remains profitable when proper cultural management and efficient scheme are employed (BPI, 2014).

Furthermore, peanut has been a popular crop in the Philippines, its history dating back to the Spanish Era. It is one of the major field legumes grown by farmers in the provinces of the Northern Samar, Eastern Samar, Western Samar, Biliran, Leyte and Southern Leyte (Palomar et al., 1996).

Nutritionally speaking, peanuts are packed with protein, fiber and vitamin E, plus the kind of fat that lowers cholesterol rather than raising it. In the garden, peanuts are solar-powered wonders that fix their own nitrogen, and you can feed the plant tops to animals or use them as mulch, after you harvest the nuts (Janila & Mula, 2015). Additionally, peanut grown mainly for human consumption, has several uses as whole seeds or processed to make peanut butter, oil and other products. The seed contains 25-30% protein and 42-52% oil (PCAARRD, 2014).

In this study, the average number of pods, average number of seeds, average weight of pods in grams, total number of pods per plot and total weight of pods in kilogram per plot per treatment were determined.

Methodology

The equipment used in the study were the following; carabao drawn plow, trowel, shovel, bolo, sprayer, meter stick, treatment indicators, weighing scale, empty sacks, record notebook, calculator and ball pen, NSIC Pn 08 (Sikat) and NSIC Pn 10 (Yaman) peanut varieties.

The study used organic pesticides to prevent and repel insect infestation. A land area of 227.81 square meters was thoroughly prepared by cutting all grasses and putting them away from the experimental area. After clearing the area, it was plowed two times at an interval of 7 days, and then followed by harrowing. The field was divided equally into 24 plots having a dimension of 1.5 meters wide and 5 meters long.

The experiment was laid in a 227.81 m^2 well prepared field arranged in Split – Plot in Randomized Complete Block Design (RCBD) with the two (2) peanut varieties assigned as main plots and the different rates of complete fertilizer (14-14-14) as sub – plots. There were three replications in every treatment combination.

The field was divided into three blocks and each block was divided into two (2) main plots and the two main plot was divided further to four sub – plot. Each sub plot had a dimension of 1.5 meter wide and 5 meters long. Alley ways of 50 cm between blocks and 30 cm between plots was used to serve as a pathway. There were 2 rows of peanut in each plot with 23 hills per row to have a total of 46 hills per plot.

The different treatments were the following:

Main Plot: Peanut Varieties

V_1 – NSIC Pn 08 (Sikat)

V_2 – NSIC Pn 10 (Yaman)

Sub Plot: Different Rates of Complete Fertilizer (14-14-14)

F_0 – Control

F_1 – 1.63 grams/hill

F_2 – 2.44 grams/hill

F_3–3.26 grams/hill

Treatments	Varieties		NPK Fertilizer
T_1	NSIC Pn 08 (Sikat)	Plus	Control
T_2	NSIC Pn 08 (Sikat)	Plus	1.63 grams/hill
T_3	NSIC Pn 08 (Sikat)	Plus	2.44 grams/hill

T_4	NSIC Pn 08 (Sikat)	Plus	3.26 grams/hill
T_5	NSIC Pn 10 (Yaman)	Plus	Control
T_6	NSIC Pn 10 (Yaman)	Plus	1.63 grams/hill
T_7	NSIC Pn 10 (Yaman)	Plus	2.44 grams/hill
T_8	NSIC Pn 10 (Yaman)	Plus	3.26 grams/hill

Planting was done early in the morning. Peanut seeds were sown directly on the soil at a distance of 70cm between rows and 20cm between hills at the rate of four seeds per hill. It was covered with fine soil. Thinning was done 15 days after germination leaving only one plant per hill. Peanut plants were watered regularly using sprinkler every morning until the plants begun to flower. Hilling-up was done thrice. This was to provide better drainage and more room for peanut pods to grow. Weeding started when weeds began to complete with the crops. This was done with the use of trowel and was followed by shallow cultivation close to the base of each plant to control weeds.

Complete fertilizer was used in the study. The rates of fertilizer application were on hectare basis and the application was done a day before sowing the seeds. The field was irrigated during critical periods such as germination, flowering, seed formation and pod filling stage. Watering was done early in the morning using sprinkler. Pests observed during the conduct of the study were leaf miner, common cutworm, bean leaf folders, leaf hoppers and bean aphid. The insect pests were repelled and prevented to invade again using organic pesticide. The attack of leaf spot was observed in peanut plant, this was controlled by spraying Dithane at four tablespoon per sixteen liters of water based on manufacturer's recommendation. Good sanitation was maintained to reduce pest and diseases infection.

Harvesting was done manually by pulling the entire plant and hand picking the pods. Variety two was harvested 90 days after planting and variety one was harvested at 95 days after planting. During this time, leaves were gradually withering and turned yellow, pods turned brownish and kernel was loosened. The harvested peanut pods from each treatment were placed in separated sacks to avoid misrepresentation of data during analysis. Each sack was marked with corresponding number of treatments.

The data gathered were the following: average number of pods; average number of seeds; average weight of pods in grams; total number of pods; total weight of pods in kilogram. Analysis of Variance (ANOVA) in Split – plot in Randomized Complete Block Design (RCBD). Scheffe Method was utilized to determine which treatments differed significantly.

Results and Discussion

The Replication x Fertilizer Tables of Average Number of Pods/Hill/Plot/Treatment

Results revealed that the sum of every replication for average number of pods in fertilizers. It showed that F_0 obtained the highest total for average number of pods/hill/plot/treatment with 372.90 and F_2 obtained the lowest total with 343.83. Replication I obtained the highest total with 492.20 and Replication III obtained the lowest total with 460.82 (see Table 2).

Fertilizer x Variety Tables of the Average Number of Pods/Hill/Plot/Treatment

Table 3 showed the computation for average number of pods per hill per plot per treatment. Result revealed that F_0 obtained the highest average number of pods per hill per plot per treatment with 62.15 and F_2 obtained the lowest average number of 57.30 pods per hill per plot per treatment. In varieties V_2 obtained the highest average number of pods per hill per plot per treatment with 61.03 and V_1 obtained the lowest average number of pods per hill per plot per treatment with 58.23.

The Replication x Fertilizer Tables of Average Number of Seeds/Hill/Plot/Treatment

Result revealed that the sum of every replication for average number of seeds in fertilizers. It showed that F_0 obtained the highest total for average number of pods/hill/plot/treatment with 663.97 and F_2 obtained the lowest total with 627.51. Replication I obtained the highest total with 881.58 and Replication I obtained the highest total with 881.58 (see Table 5).

Fertilizer x Variety Tables of the Average Number of Seeds/Hill/Plot/Treatment

Table 6 showed the computation for average number of seeds per hill per plot per treatment. Result revealed that F_0 obtained the highest average number of seeds per hill per plot per treatment with 110.66, and F_2 obtained the lowest average number of seeds per hill per plot per treatment with 104.77. In varieties V_2 obtained the highest average number of seeds per hill per plot per treatment with 108.19 and V_1 obtained the lowest average number of seeds per hill per plot per treatment with 104.77.

Replication x Fertilizer Tables of the Average Weights of Pods/Hill/Plot/Treatment

Table 8 showed the sum of every replication for average weight of pods in fertilizers. Result revealed that F_0 obtained the highest total for average weight of pods/hill/plot/treatment with 841.20 and F_1 obtained the lowest total with 760.80. Replication II obtained the highest total with 1,089.44 and Replication I obtained the lowest total with 1,047.66.

Fertilizer x Variety Tables of the Average Weights/Hill/Plot/Treatment

Result revealed that the computation for average weight of pods in grams per hill per plot per treatment. It showed that F_0 obtained the highest average number of pods per hill per plot per treatment with 140.18, and F_1 obtained the lowest average weight of pods in grams per hill per plot per treatment with 126.8. In varieties V_1 obtained the highest average weight of pods in grams per hill per plot per treatment with 147.46 and V_2 obtained the lowest average weight of pods in grams per hill per plot per treatment with 119.68 (see Table 9).

Replications x Fertilizer Tables of the Total Pods/Plot/Treatment

Table 11 showed the sum of every replication for total number pods in fertilizers per/plot/treatment. Result revealed that F_3 obtained the highest total with 18,473 and F_1 obtained the lowest total with 16,114. Replication I obtained the highest total with 22,625 followed by Replication II with 22,403 and Replication III obtained the lowest total with 22,169.

Fertilizer x Variety Tables of the Total Pods/Plot/Treatment

The result revealed that the computation for total number of pods per plot per treatment. It showed that F_3 obtained the highest total number of pods per plot per treatment with 3,078.83, and F_1 obtained the lowest total number of pods per plot per treatment with 2,685.67. In varieties V_2 obtained the highest total number of pods per plot per treatment with 2,851.67 and V_1 obtained the lowest total number of pods per plot per treatment with 2,748.08 (see Table 12).

Replication x Fertilizer Tables of the Total Weight of Pods/Plot/Treatment

Table 14 presented the sum of every replication for total weight of pods/plot/treatment in fertilizers. It revealed that F_3 obtained the highest total with 29.30 and F_1 obtained the lowest total with 22.50. Replication II obtained the highest total with 34 followed by Replication I with 32.90 and Replication III obtained the lowest total with 32.20.

Fertilizer x Variety Tables of the Total Weights of Pods/Plot/Treatment

Result revealed that the computation for total weight of pods in kilogram per plot per treatment. It showed that F_3 obtained the highest average number of seeds per hill per plot per treatment with 4.88, and F_0 obtained the lowest average number of seeds per hill per plot per treatment with 3.75. In varieties V_2 obtained the highest average number of seeds per hill per plot per treatment with 4.15 and V_1 obtained the lowest average number of seeds per hill per plot per treatment with 4.12 (see Table 15).

Table 1. Average Number of Pods of Two Varieties of Peanut with Four Levels of Fertilizers in Split Plot Design with Three Replications

Variety	**Average Number of Pods/hill/plot/treatment**		
	Rep. I	Rep. II	Rep. III
F_0			
V_1	64.61	56.23	65.61
V_2	64.61	56.23	65.61
F_1			
V_1	60.92	55.15	54.15
V_2	61.46	67.38	53.69
F_2			
V_1	55.23	56.38	53.00
V_2	55.46	76.38	47.38
F_3			
V_1	61.07	57.53	58.92
V_2	68.84	58.92	57.61

Table 2. The Replication x Fertilizer Tables of Average Number of Pods/hill/plot/treatment

Fertilizers	Average Number of Pods (RA)			
	Rep. I	Rep. II	Rep. III	Total (A)
F_0	129.22	112.46	131.22	372.90
F_1	122.38	122.53	107.84	352.75
F_2	110.69	132.76	100.38	343.83
F_3	129.91	116.45	116.53	362.89
Rep. Total (R)	492.20	478.58	460.82	
Grand Total				1,432.32

Table 3. Fertilizer x Variety tables of the Average Number of Pods/hill/plot/treatment

Fertilizers	Average Number of Pods (AB)			
	V_1	**V_2**	**Total**	**Mean**
F_0	186.45	186.45	372.90	62.15
F_1	170.22	182.53	352.75	58.79
F_2	164.61	179.22	343.83	57.30
F_3	177.52	185.37	362.89	60.48
Variety total (B)	**698.80**	**733.57**	1,432.37	
Mean	58.23	61.13		59.63

Table 4. Average Number of Seeds of Two Varieties of Peanut with Four Levels of Fertilizers in Split Plot Design with Three Replications

Variety	Average number of seeds/hill/plot/treatment		
	Rep. I	**Rep. II**	**Rep. III**
F_0			
V_1	126.92	105.76	109.23
V_2	119.07	81.46	121.53
F_1			
V_1	106.15	85.69	96.76
V_2	121.46	126.30	99.84
F_2			
V_1	97.92	110.92	104.61
V_2	98.23	137.30	78.53
F_3			
V_1	103.76	101.53	108.00
V_2	108.07	103.61	102.92

Table 5. The Replication x Fertilizer Tables of Average Number of Seeds/hill/plot/treatment

Fertilizers	Average Number of Seeds (RA)			
	Rep. I	**Rep. II**	**Rep. III**	**Total**
F_0	245.99	187.22	230.76	663.97
F_1	227.61	211.99	196.60	636.20
F_2	196.15	248.22	183.14	627.51
F_3	211.83	205.14	210.92	627.89
Rep. Total (R)	881.58	852.57	821.42	
Grand Total				2,555.57

Table 6. Fertilizer x Variety tables of the Average Number of Seeds/hill/plot/treatment

Fertilizers	Average Number of Seeds (AB)			
	V_1	**V_2**	**Total**	**Mean**
F_0	341.91	322.06	663.97	110.66
F_1	288.60	347.60	636.2	106.03
F_2	313.45	314.06	627.51	104.59
F_3	313.29	314.60	627.89	104.65
Variety total (B)	**1,257.25**	**1,298.32**	2,555.57	
Mean	104.77	108.19		106.48

Table 7. Average Weight of Pods of Two Varieties of Peanut with Four Levels of Fertilizers in Split Plot Design with Three Replications

Variety	Average weights of Pods/hill/plot/treatment		
	Rep. I	**Rep. II**	**Rep. III**
F_0			
V_1	150.03	153.11	180.16
V_2	123.84	99.76	134.30
F_1			

V_1	138.31	133.04	130.24
V_2	132.30	122.15	104.76
F_2			
V_1	168.08	143.10	147.53
V_2	89.23	162.07	92.07
F_3			
V_1	124.72	133.14	168.23
V_2	121.15	143.07	111.46

Table 8. Replication x Fertilizer tables of the Average Weights of Pods/hill/plot/treatment

Fertilizer	Average weights (RA)			
	Rep. I	**Rep. II**	**Rep. III**	**Total**
F_0	273.87	252.87	314.46	841.20
F_1	270.61	255.19	235.00	760.80
F_2	257.31	305.17	239.60	802.08
F_3	245.87	276.21	279.69	801.77
Rep. Total (R)	1,047.66	1,089.44	1,068.75	
Grand Total				3,205.85

Table 9. Fertilizer x Variety tables of the Average Weights/hill/plot/treatment

Fertilizers	Average weights (AB)			
	V_1	**V_2**	**Total**	**Mean**
F_0	483.16	357.9	841.06	140.18
F_1	401.59	359.21	760.8	126.8
F_2	458.71	343.37	802.08	133.68
F_3	426.09	375.68	801.77	133.62
Variety total (B)	**1,769.55**	**1,436.16**	3,205.71	
Mean	147.46	119.68		133.57

Table 10. Total Pods of Two Varieties of Peanut with Four Levels of Fertilizers in Split Plot Design with Three Replications

Variety	Total pods/plot/treatment		
	Rep. I	**Rep. II**	**Rep. III**
F_0			
V_1	2,581	2,668	2,783
V_2	3,019	2,437	2,891
F_1			
V_1	2,816	2,570	2,576
V_2	2,853	2,723	2,576
F_2			
V_1	2,622	2,573	2,346
V_2	2,621	3,631	2,438
F_3			
V_1	2,898	2,902	3,642
V_2	3,215	2,899	2,917

Table 11. Replications x Fertilizer Tables of the Total pods/plot/treatment

Fertilizer	Total pods (RA)			
	Rep. I	**Rep. II**	**Rep. III**	**Total**
F_0	5,600	5,105	5,674	16,379
F_1	5,669	5,293	5,152	16,114
F_2	5,243	6,204	4,784	16,231
F_3	6,113	5,801	6,559	18,473
Rep. Total (R)	22,625	22,403	22,169	
Grand Total				67,197

Table 12. Fertilizer x Variety tables of the Total pods/plot/treatment

Fertilizers	Total Pods (AB)			
	V_1	**V_2**	**Total**	**Mean**
F_0	8,032	8,347	16,379	2,729.83
F_1	7,962	8,152	16,114	2,685.67
F_2	7,541	8,690	16,231	2,705.17
F_3	9,442	9,031	18,473	3,078.83
Variety total (B)	**32,977**	**34,220**	67,197	
Mean	2,748.08	2,851.67		2,799.86

Table 13. Total Weight of two Varieties of Peanut with four levels of fertilizers in split plot design with three replications

Variety	Total Weight of Pods/plot/treatment		
	Rep. I	**Rep. II**	**Rep. III**
F_0			
V_1	3.30	4.20	3.40
V_2	4.30	3.80	3.40
F_1			
V_1	4.00	3.80	3.50
V_2	3.50	4.20	4.00
F_2			
V_1	3.60	4.50	4.20
V_2	4.10	4.20	3.80
F_3			
V_1	4.90	4.80	5.20
V_2	5.20	4.50	4.70

Table 14. Replication x Fertilizer tables of the Total Weight of Pods/plot/treatment

Fertilizer	Rep. I	Rep. II	Rep. III	Total
F_0	7.60	8.00	6.90	22.50
F_1	7.50	8.00	7.50	23.00
F_2	7.70	8.70	8.00	24.40
F_3	10.10	9.30	9.90	29.30
Rep. Total (R)	32.90	34.00	32.20	
Grand Total				99.20

Table 15. Fertilizer x Variety tables of the total weights of pods/plot/treatment

Fertilizers	Total Weight (AB)			
	V_1	**V_2**	**Total**	**Mean**
F_0	10.90	11.60	22.50	3.75
F_1	11.30	11.70	23.00	3.83
F_2	12.30	12.10	24.40	4.07
F_3	14.90	14.40	29.30	4.88
Variety total (B)	**49.40**	**49.80**	99.20	
Mean	4.12	4.15		4.13

Conclusions

Based on the result of the study, the following conclusions were drawn.

1. There was no significant difference on the average number of pods per hill per plot per treatment using different varieties, different rates of complete fertilizer and among the treatment combinations.
2. There was no significant difference on the average number of seeds per hill per plot per treatment using different varieties, different rates of complete fertilizer and among the treatment combinations.
3. There was no significant difference on the average weight of pods in grams per hill per plot per treatment using different rates of complete fertilizer and among the treatment combinations. However there was a significant difference on the average weight of pods in grams per hill per plot per treatment using different varieties of peanut.
4. There was no significant difference on the total number of pods per plot per treatment using different varieties, different rates of complete fertilizer and among the treatment combination.
5. There was no significant difference on the total weight of pods in kilogram per plot per treatment using different varieties of peanut and among the treatment combinations. However there was a significant difference on the total weight of pods in kilogram per plot per treatment using different rates of complete fertilizer.

Recommendations

Based on the findings and conclusions, the author came up with the following recommendations:

1. The adoption of two varieties, different rates of complete fertilizer and treatment combinations to obtain more number of pods per hill per plot per treatment;
2. The adoption of two varieties, different rates of complete fertilizer and treatment combinations to obtain more number of seeds per hill per plot per treatment;
3. The adoption of V_1 (NSIC Pn 08) to obtain heavier weight of pods in grams per hill per plot per treatment;
4. The adoption of two varieties, different rates of complete fertilizer and treatment combinations to obtain more number of pods per plot per treatment;
5. The adoption of F_3 (4 bags of complete fertilizer) to obtain heavier weight of pods in kilogram per plot per treatment; and
6. Economically, the adoption of treatment four combination of NSIC Pn 08 peanut variety and 4 bags of complete fertilizer to obtain high profit for the production of peanut.

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