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HOMOGENEOUS SUBSET STANCE OF RHIZOME LENGTH AND OPERATIONAL MACHINE SPEED ON PLANTING PARAMETERS OF TRACTOR DRAWN TURMERIC PLANTER

Muogbo P. C[1], Obasa P. A[2*]

[1] *National Root Crops Research Institute, Nyanya Sub- Station, Abuja, Nigeria.*

[2] *Department of Agricultural and Bioresources Engineering, Federal University of Technology, Minna, Niger State Nigeria.*

Corresponding Author:* ***Obasa P. A*

ABSTRACT
The production of the relatively homogeneous Subsets provided the request for a post-hoc test to address multiple comparisons of data collected on the planting parameter of the developed tractor turmeric planter consisting of a ground drive, adjustable metering system, furrow opening, furrow closing unit, press wheel, hopper, residue cutting edge and power transmission mechanism. The planting recital measurement of the turmeric rhizome planter was carried out using two variables, three levels of turmeric rhizome lengths at 30 mm, 45 mm and 60 mm and three levels of operating speeds at 8 km/h, 10 km/h and 12 km/h respectively. The Turkish post-hoc test and analysis of variance (ANOVA) reflects a substantial level between the post-hoc groups which provides better information on the factors impact within the framework community of the experimenter. Rhizome length as a significant effect in the community on planting production, fuel consumption, slipping of the wheel Mainly the rhizome length of 60mm and no significant effect between 30mm and 45mm although there is no significant effect on the average field capacity of all three levels, the operating speed of the established planter was significant at each of the three levels of the plant parameter test performed all the reactions only the average field capacity shown. The planting parameters for the factors considered at three levels showed a significant impact at each level and demonstrated the actions of each treatment.

KEYWORDS: *Development, Efficiency, Homogenous, Planter, Rhizome.*

INTRODUCTION
Post-hoc analysis also offers even more insight into discrepancies or similarities between particular groups and is thus an essential step in the analysis of data. Tukey's test is only one of the many approaches available for post-hoc analysis and, as mentioned above, is considered to be the best approach in a wide range of cases. (Aaron, 2018). Homogeneous subset test shows honest substantial difference of data that can be HSD or LSD statistic; Post-Hoc tests implies to interpret the effects of experimental data. They are also based on the likelihood of reaching at least one false conclusion in a sequence of hypotheses tests; the probability of at least one type I error in a collection of comparisons.

The most popular post-hoc tests are the following: The Studentized Range (q) is the discrepancy between the largest and the smallest data point in the sample determined by the sample standard deviations (Laerd,2018). The studentized range distribution is the probability distribution of studentized categories for discrete, equally distributed random variables that are normally distributed. It is mainly used in post-hoc studies, such as Tukey's HSD, to reduce the probability of Type I error. The form of the studentized range distribution depending on the sense of checking if two means are identical, it is similar to the T distribution. However, it takes into consideration of the number of means available. The more it means, the higher the critical value.

The Tukey Test (or Tukey procedure), also known as Tukey's Honest Significant Difference Test, is a post-hoc test based on the studentized range distribution. An ANOVA test can tell you if your overall results are statistically significant, but it won't tell you exactly where the differences lie. After running an ANOVA and finding significant results, you can run Tukey's HSD to find out which specific groups means (compared to each other) are different. The test compares all possible means pairs (Stephanie, 2017).

To exam all pairwise assessments among means using the Tukey HSD, calculate HSD for each pair of means using the following formula:

$$HSD = \frac{M_i - M_j}{\sqrt{\frac{MS_w}{n_h}}}$$

The output of the Homogenous Subsets is constructed by a request for post-hoc tests and addresses the same questions as the Multiple Comparisons table for post-hoc analysis, i.e. which pairs of groups have significantly different means of depending on the variable. Like the Multiple Comparisons table, the output of the Homogenous Subsets would not be interpreted if the main effect (in the Between Subjects Effect or ANOVA table) was not significant. Some post-hoc tests are only reported as homogenous subset output (e.g. Duncan, SNK); some are only reported as multiple comparison tables (e.g. Sidak, Tamhane); and some are reported in both formats (e.g.Tukey HSD, Scheffe).

The developed turmeric planter tractor was tested for different forward speeds and transmission ratios. Performance indices such as missing index (imiss), precision index (ip) rhizome multiple index (imulti), feed quality index (iqf) and rhizome spacing (is) were used to evaluate rhizome planter performance in many previous reports (Singh, and Gautam 2015; Albushari,S.A. 2016; Mohamed, et al., 2016). The mean turmeric spacing ranged from 21.66 to 32.63 cm and from 20.53 to 31.13 cm, respectively. Optimum performance for the planting of ginger and Turmeric was at a forward speed of 0.97 km hr^{-1} and a transmission ratio of 1:1.25. The average field capacity and efficiency was 0.14 ha hr^{-1} and 78.76 percent respectively (Muogbo *et al.,*2019). Cost and time savings for mechanical planting were approximately 59.52% and 96.57% compared to manual planting. Based on the results of the performance evaluation, it is concluded that the developed rhizome planter is economical and efficient for rhizome planting (Muogbo *et al.,*2019).

METHODOLOGY

Post-hoc test based on the studentized range distribution using Tukey's Honest Significant Difference Test, was used to analysed the planting parameter of the performance evaluation conducted on the developed turmeric rhizome tractor drawn turmeric planter. Two factors and three of turmeric rhizome lengths at 30 mm, 45 mm and 60 mm and three levels of operating speeds at 8 km/h, 10 km/h and 12 km/h respectively were analysed.

RESULT AND DISCUSSION

Descriptive statistics (Table 1) provide some useful descriptive statistical information, including mean, standard deviation and 95 per cent confidence intervals for the dependent variable planting parameter being investigated for each separate Group (fuel consumption, planting efficiency, wheel slippage, average field capacity) as well as when all groups are combined (Total). This table describes the standard deviation data of 2.91 percent for plant efficiency, 1.66 machine speed, with 18.51 field capacity.

Table 1: Descriptive Statistics of planting parameter of developed turmeric planter

	N	Minimum	Maximum	Mean	Std. Deviation
Machine speed	27	8	12	10.00	1.664
Mean field capacity (hah-1)	27	.61	97.00	4.3452	18.517
Efficiency (%)	27	60.00	69.80	64.830	2.910
Fuel consumption	27	2	4	3.01	0.546
Wheel slippage	27	3	4	3.73	0.444
Valid N (listwise)	27				

Homogeneous subsets of rhizome length (Tables 2) show which groups have the same mean planting condition and which of the groups have different mean planting status. It was noted that the mean field capacity group subset 1 was the same superscript, which means that there was no significant difference within the group, while among other response subsets there was a significant difference in the fuel consumption of the tractor during planting in relation to the turmeric lengths at all three levels. The planting efficiency group was significant at a turmeric length of 45mm (64.21±0.03[a]) while there was no statistically significant difference in efficiency over the length of the planting. 30 mm and 60 mm (65.15±0.10[b], 65.12±0.26[b]). The wheel slippage analysis in relation to the length of the rhizome planted was significant at 45mm and 60mm (3.78±0.32[b]; 3.69±0.05[a]) but there is no significant difference between 30mm and 45mm (3.72±0.01[ab]); 30mm and 60mm (3.72±0.01[ab])

Table 2: Homogeneous subset of rhizome length on planting parameters

Rhizome length	Mean field capacity (hah-1)	Efficiency (%)	Fuel consumption	Wheel slippage
30	0.80±0.05[a]	65.15±0.10[b]	3.19±0.06[c]	3.72±0.01[ab]
45	11.4±0.002[a]	64.21±0.03[a]	2.81±0.20[a]	3.78±0.32[b]
60	0.81±0.08[a]	65.12±0.26[b]	3.022±0.4[b]	3.69±0.05[a]

Means for groups in homogeneous subsets are displayed. Based on observed means. The error term is Mean Square (Error) = 0.002. Uses Harmonic Mean Sample Size = 9.000.

A Tuckey post-hockey test in Table 3 revealed that the machine speed contributed a significant problem to the planting parameter in this study only the mean field capacity which shows no effect in relation to the speed at 8 Kmh^{-1}, 10 Kmh^{-1} and 12 Kmh^{-1} and higher speeds (0.80±0.05[a], 11.42±0.002[a], 0.81±0.08[a]). Compared to other parameters with pure difference at planting efficiency 62.14±0.40[a], 63.96±1.02[b] , 68.39±0.75[c] ; fuel consumption increases with speed in planting with variation of 0.4 liter/min to 0.63 liter/min which is in conformed with established theory on manually operated multi-crop planter by (Kalay and Mose 2017; Nwakuba *et al.*, 2018). There was also statistically significant difference between the wheel slippage groups (4.27±0.58[c], 3.71±0.07[b], 3.23±0.50[a]) it shows that the high the speed of planting the less the wheel slippage.

Table 3: Homogeneous subset of machine speed effect on planting parameters of developed turmeric planter

Machine speed Kmh^{-1}	Mean field capacity (hah^{-1})	Efficiency (%)	Fuel consumption (lha^{-1})	Wheel slippage %
8	0.80 ± 0.05^{a}	62.14 ± 0.40^{a}	2.4 ± 0.44^{a}	4.27 ± 0.58^{c}
10	11.42 ± 0.002^{a}	63.96 ± 1.02^{b}	3.03 ± 0.29^{b}	3.71 ± 0.07^{b}
12	0.81 ± 0.08^{a}	68.39 ± 0.75^{c}	3.6 ± 0.92^{c}	3.23 ± 0.50^{a}

Means for groups in homogeneous subsets are displayed. Based on observed means. The error term is Mean Square (Error) = 0.002. Uses Harmonic Mean Sample Size = 9.000.

Estimated Marginal Means of Mean Field Capacity (hah-1) mean plot (Figure 1) shows that the relationship of planting machine speed and rhizome length follows the same trend at 8 and 10 kmh^{-1}, which means that there is no major impact on both speeds in terms of length while the speed at 8 and 10 kmh^{-1}.

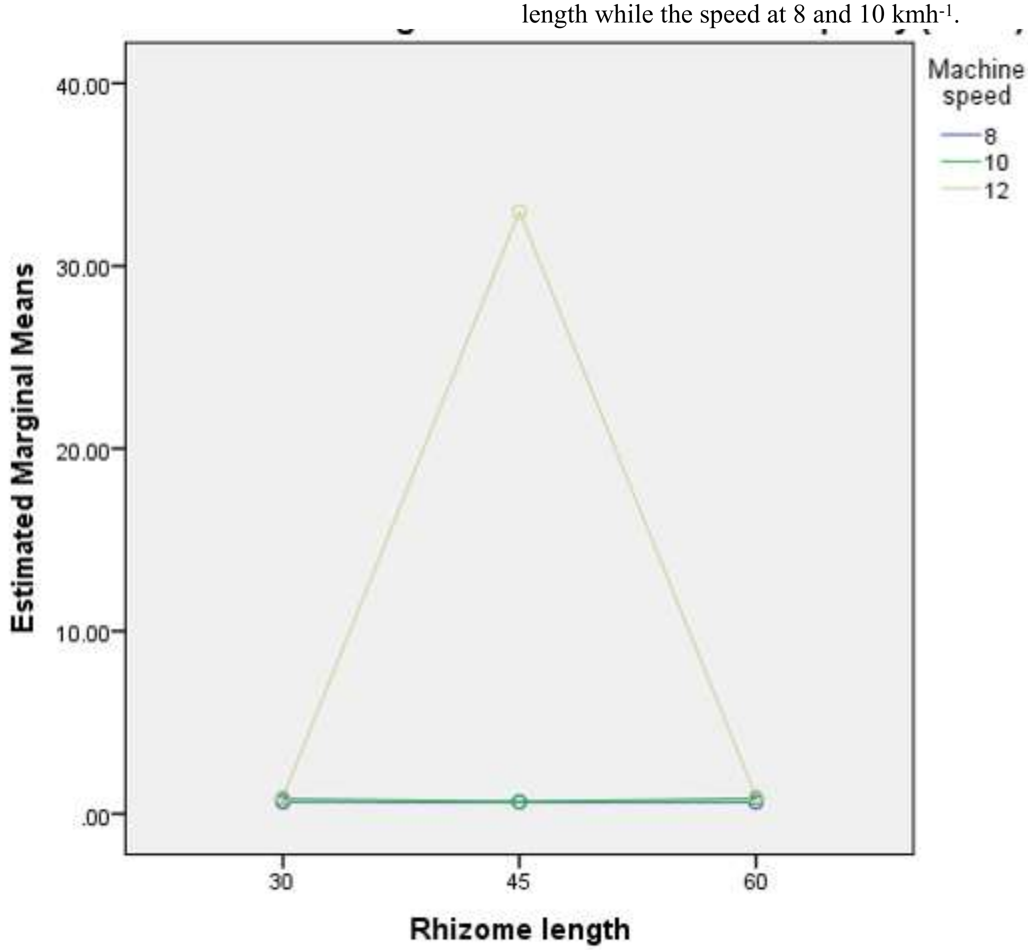

Figure 1: Estimated Marginal Means of Mean Field Capacity (hah-1)

12 kmh^{-1} increased with a shift in rhizome length but decreased from 45 mm to 60 mm in length,

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which suggests that there is a major impact on the interaction of the two key factors at 12 kmh^{-1}, the result was commensurate with the earlier analysis.

The Mean Complot Estimated Marginal Means of Efficiency (percent) indicates that the relationship between the speed of the planting machine and the length of the rhizome following the same trend at 8 and 10 kmh^{-1}, which means that there is no major impact on both speeds in terms of length (Figure 2). The mean efficiency decreased at a rhizome length of 45 mm but the speed at 12 kmh^{-1} opposed to the Marginal Means of Efficiency (percentage) at 8 and 10 kmh^{-1}, the mean planting efficiency at a system speed of 12 kmh^{-1} was higher in the values teams. Minimum performance was 67.8 per cent at 60mm rhizome length, while the highest was 69.9 per cent at 45mm rhizome length. This was consistent with the study (Oduma *et al.,* 2014; Muogbo *et al*., 2019). on field performance analysis of developed turmeric planter.

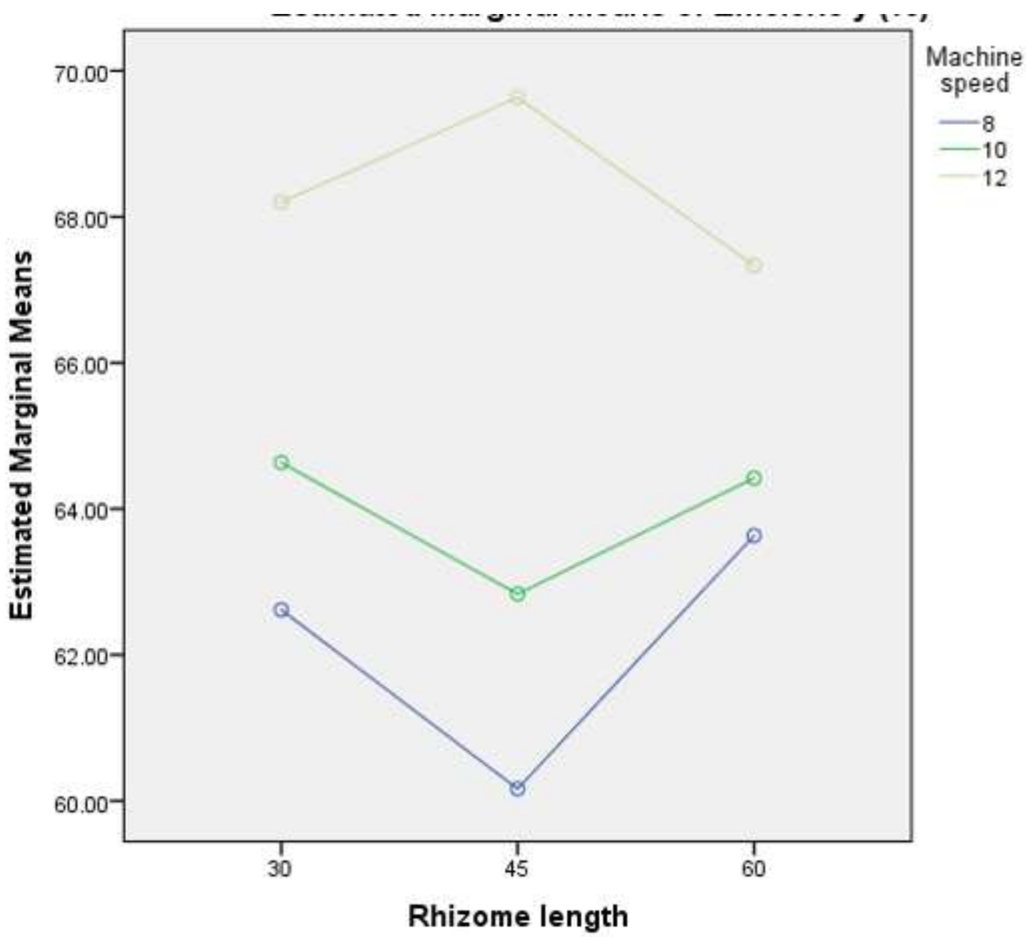

Figure 2: Estimated Marginal Means of Efficiency (%)

The Mean plot Estimated Marginal Means of Wheel slippage (%)

The relationship between the speed of the planting machine and the length of the rhizome indicates that the graph (Figure 3) shows the speed at 12 kmh^{-1} as the lowest slippage of the wheel at a margin of 3.25 to slightly above 3 points compared to the other two speeds measured in this analysis with a median slippage of 3.5 to 4.25 points above the speed as a relative impact on the degree of slipping of the machine during planting. There is an important influence on the duration of the speed at the three speeds. The wheel slippage varied at various speeds to lengths at rhizome lengths between 45 mm, speeds of 10 and 12 kmh^{-1} having the maximum slippage at rhizome sizes of 45 mm before starting decrease while

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the slippage of the wheel increased with an increase in rhizome size. (Ugwuishiwu and Onwualu, 2009) indicated that the speed of the mechanized machine was affected by the rate of field slippage. The speed at 8 kmh^{-1} shows major changes at 10 and 12 kmh^{-1} speeds relative to the turmeric rhizome length.

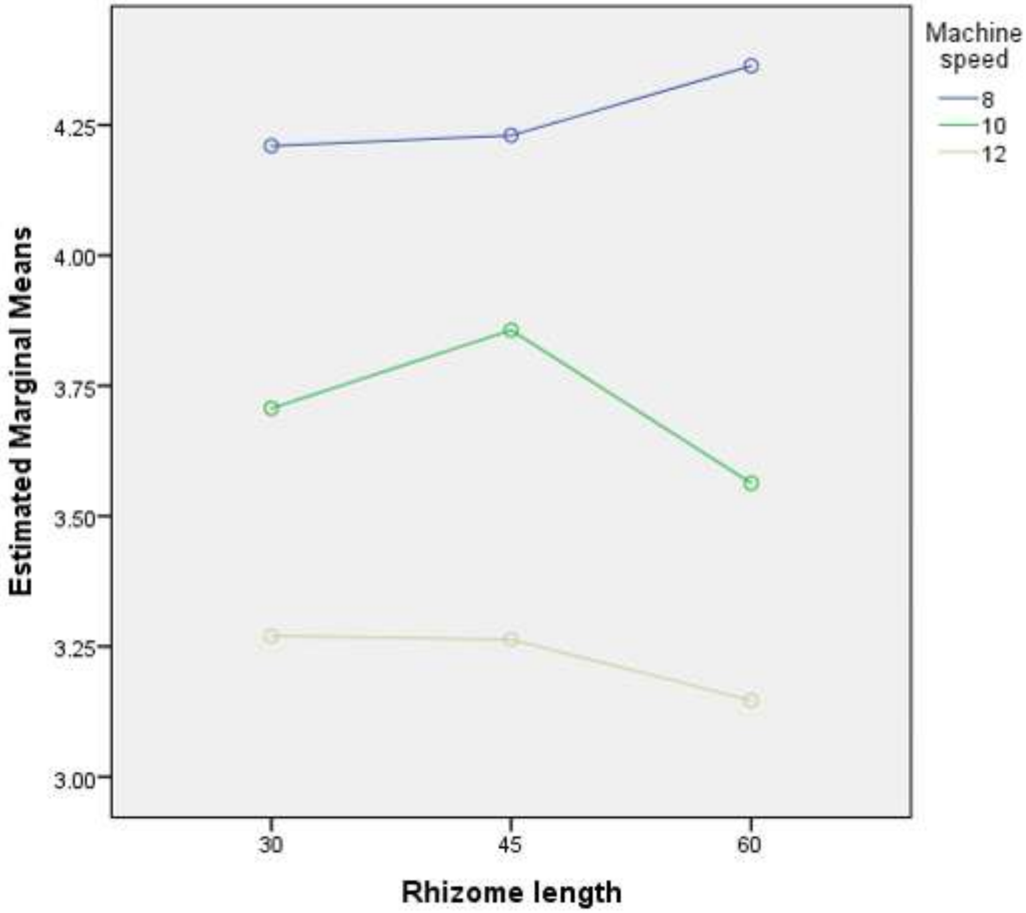

Figure 3: Estimated Marginal Means of Wheel slippage

CONCLUSION

This research was able to determine the key sublevel factor as it affects the plating parameters within the group and between the test groups. Differences and improvements in each test parameter have been resurrected to better explain each degree of meaningful impact. The interaction of planting speed and turmeric rhizome length was a graphic representation and can be used to further extrapolate other regions within the 8 to 12kmh^{-1} treatment boundary and the 30 to 60 mm turmeric rhizome length.

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