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THE PRODUCTIVITY OF TURMERIC (CURCUMA LONGA) AS INFLUENCED BY NUTRIENTS AND RHIZOMES SIZE GROWN IN MAKURDI, BENUE STATE, NIGERIA.

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ABSTRACT

The experiment was carried out at Agronomy Teaching and Fesearch Farm of Federal University of Agriculture at 7○ 38Nand longitude 8○ 38E and 97m above sea level in southern guinea savannah agro-ecological zone of Nigeria to investigate the productivity of Turmeric (Curcuma longa) as influenced by nutrients and rhizomes size grown in Makurdi, Benue State. The experiment was laid in a Randomized Complete Block Design (RCBD) with three replications. Treatment were cow dung 5t/ha, poultry droppings 5t/ha, NPK fertilizer at 0.22t/ha and control and the rhizomes sets used are small set (S1) and large set (S2). Data collected were number of leaves, plant height, Number of plant per hill fourth nightly after emergence (WAE) and yield weight was taken during harvest. The data were analysed using (ANOVA) which indicated that Poultry droppings shows superiority over the other treatment used and large set of rhizomes supersede the small set rhizomes used during the work. Therefore the used of organic source of nutrient of poultry dropping which is less expensive and the use of large size rhizome is more preferable as planting material for turmeric farmers in this location for optimum yield.

Keyword: Turmeric, sett, rhizomes and Nutrients

INTRODUCTION

Turmeric is believed to be originated from south Asia around Vietnam, China and west India (Kew, 2016) the crop has been known as a domestic plant and not found in the wild, it is sterile but grows vigorously from rhizomes. The horizontal roots Is important s, rhizome is both planting material and use commercially as source of money to the farmer. The crop is long duration crop 8-9 months and produce different sizes of propagules from the mother (shoot base) to daughter rhizome which are used as spice The daughter rhizomes don't develop at the same time from the shoot base, the size of the sett plays an important role has vegetative part of the succeeding year, which is mostly left to the using of small size and sometimes unwanted part of the plant where the large size are use as source of food and income to the farmer. Therefore it is necessary to determine the optimum size of rhizome seed for turmeric cultivation. Turmeric being an exhaustive crop response well to nutrition, hence the need for its nutrients source to be determine if production is to meet up with its demand, most chemical fertilizer are expensive to local farmer and difficult for the farmer to ascertain the quality hence the need to look into other sources of nutrient such as organic source which is readily available and its ability to improve the soil structure and fertility stature (Kamal and Yousuf 2012). The problems need to be address if turmeric cultivation is to done in large or commercial quantity. Turmeric is commercially cultivated in the southern part of Nigeria due to the subtropical climate, but its production is limited because of the local farmers lack proper cultivation Technology in terms of spacing, sett size and nutrients requirement among others (Kamal and Yousuf, 2012). The demand for the crop is increasing due to its medicinal and nutrition value hence the need to come up with which size do farmer use as propergules in cultivation of turmeric. In Nigeria about 19 States are prominent in turmeric production and it's given many names depending on the locality (Olojede et al 2005). However, it has been observed that quantity that may be produced during planting season may not be sufficient for consumption. It is necessary to know the best practice and rhizome size which could help in increasing the production of turmeric hence the need for this work. Farmers will want to keep the small size for propagation and sell the big size as source of income. Hence different nutrients source may be required for good yield. The objectives of the work therefore is to determine the effects of set rhizome size and nutrient source on the growth and yield of turmeric.

MATERIAL AND METHODS

The experiments was conducted during the rainy season of 2018 at the Teaching and Research farm, University of Agriculture, Makurdi (7^{O} 41 N and 8^{o} 37^{I} E and 400m above sea level). The experiment that was laid in a randomized complete block design (RCBD) with three replicate, a $4m^2$ plot was laid out with 1m between plots and 0.5m between blocks. There were 10 plots each within a block which gave the total number of 30 plots for the study. The treatment where; NPK, Cow dung, poultry manure and control for rhizome; small size (2-3cm) with 10g and large size (8-10cm) with 20g formed the treatment. The (2) two organic sources: Cow dung (Dry matter 12%, Organic Material 11%, Total Nitrogen 14.0%, Total Phosphorus 0.3% and Total Potassium 0.6%) and Poultry dropping (100% Dry Matter, Organic Material 65%, Total Nitrogen 5.9%, Total Phosphorus 1.41% and Total Potassium 2.72%) where collected from both births

and cattle that where kept under intensive management, where the organic manure where kept/stored to undergo partial decomposition for five months following the recommendation of (Bello, 2015) with 5tones/ha before incorporation into the soil, the different rhizomes set sizes were planted at the spacing of 30 X 30cm with the depth of 5-7cm, Agronomic practice such as wedding was done manually at 2weeks after sowing and earthing up at 6 weeks after planting, fertilizer application of N.P.K 15:15:15 was done 4weeks after planting, all the data were collected within the net plot of 4m2 where a total of 10 plants were tagged for data collection within each net plot. The parameters recorded were plant height (was taken with the aid of measuring tape from the base of the plant to the tip), number for leaves (were counted fortnightly) from 10 plants that was tagged and the average used number of plant per hill at 2, 4, 6, 8, 10 and 12 weeks after emergence (WAE) and yield weight was recorded at harvest. All data collected were subjected to analysis of variance (ANOVA) using General Linear Model procedure SAS Institute (1996) while least significant difference (LSD) at 5% level of probability was used in separating the means.

RESULTS AND DISCUSSION

Table 1 is the productivity of Turmeric as influenced by nutrients and rhizomes size on number of leaves per plant. Difference was observed from 2 to 12 week after emergence, in response to nutrients source the application NPK fertilizer had the highest number of leaves in 10 and 12weeks after emergence the different were significant at 5% level of probability. This could probably be attributed chemical nutrient to dissolving and been utilized by plant for both vegetative growth and bulking of rhizomes as supported by the work Alam., et al (2003) On rhizome size significant difference was observed at 8 and 10 week after emergence with large set size having greater number of leaves at week 12 after emergence. This could be as a result of the food reserved in the rhizomes large size which enhanced plant vegetative growth as reported by Blay et al. (1988) in his work on ginger. This might have influence not only the plant vegetative part, but also have positive effect on crop yield. Table 2 shows the interaction on the productivity of Turmeric (curcuma longa) as influenced by nutrients and rhizomes size grown in makurdi On number of leaves shows the interaction of between NPK and large sett shows highest number of leaves at 12 weeks after emergence this could be attributed to the fact that chemical nutrient have fast ability to dissolve and be utilized by plant couple with the facts that large size rhizomes have more stored food in them leading the its vigorous growth in terms of number of leaves as supported by the work of Mohapatra at el. (2009). Table 3 shows the nutrients and rhizomes size on turmeric height, Nutrient source has significant effect on turmeric canopy height 8, 10 and 12 after emergence Application of NPK had recorded the tallest plant at these sampling period This could be as a result of the effects chemical fertilizer which is fast in releasing nutrient elements for absorbtion and utilization by plants leading to vegetative growth as reported by Fagam (2015). On set rhizome size there was a difference observed where large size have the taller plants at 2 to 12 weeks after emergence than the small set size. This could not be far from the facts that foods reserved in large size set were used by plants influencing teller plants. This collaborate with the work of Hossain, et al (2005) where he reported larger rhizomes recorded taller plant in ginger which are of the same family. Table 4 shows interaction between nutrients source and sett size on plant height of turmeric grown in makurdi at 12 weeks after emergence shows plant height had taller plant with the combination of NPK and large size sett, this could be attributed to the fact that perfect combination of large size rhizomes with NPK fertilizer could lead the tall plants as a result of food storage and fast release of nutrient for plant utilization, Having a second look at the result the combination of NPK and large size rhizomes gave the tallest plant, this could be attributed to early application done to the soil at 2 weeks after emergence as suggested and reported by Velmurugan at el (2007) which will lead to vigorous plant growth to intercept sun light for photosynthetic activities and metabolic processes as a result of fast release of nutrient content by chemical fertilizer leading to taller plants.

Table 5 is the effects of nutrients and rhizomes size on number of plant/corm of turmeric, significant different was recorded on nutrient source at 10 and 12 weeks after emergence, the application of poultry droppings recorded high in terms of number of plant/corm, this could be as the result of poultry dropping having biding ability, improve soil structure and water holding capacity which in turn affects corm formation, this accession is supported by the earlier finding of Fagam (2013) who reported that organic manure had ability to initiate corm formation which its release is slow but effective. On set size, significance different was observed where large size had more number of plants/corm than the small size at 10 and 12 weeks after emergence, this is not far from the facts that large rhizome size had more food preserved in them to small size rhizomes, this finding is in agreement with the work of Iheanacho et al. (2016) who reported that large size rhizomes had more food reversed than small size which affect not only growth but corm formation. The interaction between nutrient source and sett size on number of plant/corn (Table 7) shows a perfect interaction at 12 Weeks after emergence with the interaction of poultry dropping and large sett having higher number of plants/corm when compared with the other treatment used which could be attributed to fast release of poultry droppings due to partial decomposition before incorporating it to the soil as suggested by Bello(2015) poultry manure releases it nutrients fast when compared with other organic source of nutrients and utilized for plant corn formation as reported by (Garba 2014). Table 7 shows the effects of nutrient and rhizome size on the yield and yield related character of turmeric. Difference significantly existed in nutrients where NPK fertilizer had 3.3 tonnes/ha when compared other sources of nutrients used, this is linked to the fact that chemical fertilizers are fast utilized by plants for vegetative growth, yield related characters and overall yield as reported by Mandel., et al (2007). Rhizomes size shows the use of large set supersede the small set in term of yield and yield related characters, this could be as the food preservation

which did not only affect the floral part but also affect the crop overall yield. Iheanacho (2016) reported that large size of rhizomes affects vegetative part, yield and quality of rhizomes. Table 8 shows the interaction between nutrients source and sett size on turmeric yield where a perfect interaction shows highest yield with the combination of NPK and the large size sett, followed by poultry droppings with large size sett which could be attributed to the partial decomposition done of the organic source before incorporating into the soil due to its ability to release it nutrients slow as reported by Bello (2015) and Jack (1988) when compared with the application of NPK with large size set which yielded more due to its ability to dissolve fast and be utilized by the plant. Fagam (2015) lend support to the above accession reported the application of chemical fertilizer to plants affects both the vegetative grow and yield more when compared with organic source due to its fast ability to release it nutrients and the ability for the plants to absorb such nutrients. Kamal and Yousuf (2012) work on turmeric reported that, cow dung recorded 5.18t/ha and poultry dropping 4.36t/ha which could be due to the effect of planting date and amount of nutrient application during their work. The low yield recorded in the combination of NPK and small sett when compared with organic source of nutrients could be as a result of leaching of chemical fertilizer in the soil and low storage in small sett. Zelalem (2009) reported in his work that organic source of nutrients releases its nutrients slow and needed in large quantities to be effective for the required results, he also added that it improve the soil structure and nutrient status and in turn improve crop yield.

CONCLUSION AND RECOMMENDATION

The finding in this work show the application of poultry dropping at 5tone/ha which is more soil friendly and cheap with the use of large size set yielded more when compared with the application of chemical fertilizer of NPK. It is therefore recommended for farmers of turmeric in this locality to use organic source of fertilizer preferably poultry dropping with large size rhizome set for optimum yield and soil improvement.

Table 1. Effects of Nutrients and Set Size on Turmeric Leaves Grown in Makurdi, Benue State.

Treatments	Leaves (WAE)					
Nutrients source (N)	2	4	6	8	10	12
Cow dung	3.05	5.04	7.05	11.39	20.83	31.60
NPK	3.16	5.66	7.27	12.22	24.55	38.45
Poultry dropping	3.27	5.48	7.11	11.98	19.94	29.30
Control	3.00	5.01	6.50	11.01	18.94	27.08
Level of Significance	NS	NS	NS	NS	*	*
LSD	1.50	2.12	2.13	2.10	2.01	3.30
Set size (S)						
Small	2.99	5.10	7.80	11.14	18.91	27.80
Large	3.33	5.54	7.99	14.12	23.93	39.30
Level of significance	NS	NS	NS	*	*	*
LSD	2.00	2.11		2.32	3.20	5.24
Interaction						
N X S	NS	NS	NS	NS	*	*

WAE= Weeks After Emergence, N= Source of Nutrients, LSD= Least Significant Differences at 5% Level of Probability, NS=Not Significant at 5% Level of Probability.

Table 2. Interaction between Nutrient Source and Sett Size on Plant Height of Turmeric Grown in Makurdi at 12 Weeks after Emergence.

Sett Size	Cowdung	NPK	Poultry dropping	Control	
Small	31.51		38.24	32.24	29.30
Large	33.91		40.21	35.21	32.11
LSD	1.50		2.01	2.32	2.14

LSD= Least Significant Differences at 5% Level of Probability,

Table 3. Effects of Nutrients and Set Size on Turmeric Plant height Grown in Makurdi, Benue State.

Treatments	Leaves (WAE)					
Nutrients source (N)	2	4	6	8	10	12
Cow dung	12.10	23.26	29.35	41.80	55.10	72.50
NPK	13.40	23.89	30.10	52.16	66.12	80.12
Poultry dropping	13.23	22.48	29.11	40.38	54.24	70.21
Control	13.00	22.01	27.98	39.90	52.76	66.60
Level of Significance	NS	NS	NS	NS	*	*
LSD	1.50	2.12	2.13	2.10	3.25	4.92
Set size (S)						
Small	12.90	20.67	25.67	37.98	50.96	67.10
Large	15.27	25.77	32.38	44.33	76.54	85.40
Level of significance	NS	NS	NS	*	*	*
LSD	2.96	2.71	2.76	3.50	3.94	4.70
Interaction						
N X S	*	*	*	*	*	*

WAE= Weeks After Emergence, N= Source of Nutrients, LSD= Least Significant Differences at 5% Level of Probability, NS=Not Significant at 5% Level of Probability.

Table 4. Interaction between Nutrient Source and Sett Size on Plant height of Turmeric Grown in Makurdi at 12 Weeks after Emergence

Sett Size	Cowdung	NPK	Poultry dropping	Control	
Small	67.10		80.24	70.21	61.21
Large	69.11		92.01	81.14	70.01
LSD	3.11		3.21	3.42	3.14

LSD= Least Significant Differences at 5% Level of Probability

Table 5. Effects of nutrients and set size on Number of Plant/corm of turmeric grown in Makurdi, Benue State.

Nutrients source (N)	2	4	6	8	10	12
Cow dung	1.10	1.11	1.17	1.89	4.08	5.50
NPK	1.45	1.27	1.39	2.61	4.66	5.67
Poultry dropping	1.28	1.17	1.22	3.83	5.11	7.16
Control	1.10	1.16	1.20	2.45	4.00	5.11
Level of Significance	NS	NS	NS	NS	*	*
LSD	0.98	0.99	0.93	1.50	0.93	0.99
Set size (S)						
Small	1.11	1.13	1.17	1.18	3.77	5.80
Large	1.33	1.28	1.41	3.16	5.72	7.77
Level of significance	NS	NS	NS	*	*	*
LSD	0.52	0.71	0.76	0.90	1.02	1.20
Interaction						
N X S	NS	NS	NS	*	*	*

WAE= Weeks After Emergence, N= Source of Nutrients, LSD= Least Significant Differences at 5% Level of Probability, NS=Not Significant at 5% Level of Probability.

Table 6. Interaction between Nutrient Source and Sett Size on Number of Plant/corm of Turmeric Grown in Makurdi at 12 Weeks After Emergence

Sett Size	Cowdung	NPK	Poultry dropping	Control	
Small	4.91		5.21	6.21	4.11
Large	5.41		6.11	7.01	5.10
LSD	0.91		0.92	0.84	0.90

LSD= Least Significant Differences at 5% Level of Probability,

Table 7. Effects of nutrients and set size on turmeric Yield grown in Makurdi, Benue State.

Nutrients source (N)	Fresh tuber Weight(g)	Corm Length(Cm)	No. of roots per plant	Yield (Kg/ha)
Cow dung	40.42	6.99	12.10	2.8
NPK	42.91	7.87	11.24	3.3
Poultry dropping	39.22	6.98	11.11	3.9
Control	38.34	6.45	11.23	2.3
Level of Significance	NS	NS	NS	*
LSD	5.99	1.99	1.89	1.10
Set size (S)				
Small	49.23	6.89	10.11	2.3
Large	50.12	6.99	11.34	3.8
Level of significance	NS	NS	NS	*
LSD	5.28	1.01	1.99	1.01
Interaction				
N X S	NS	NS	NS	*

WAE= Weeks After Emergence, N= Source of Nutrients, LSD= Least Significant Differences at 5% Level of Probability, NS=Not Significant at 5% Level of Probability.

Table 8. Interaction between Nutrient Source and Sett Size on Number on Yield of Turmeric Grown in Makurdi at 12 Weeks after Emergence

Sett Size	Cowdung	NPK	Poultry dropping	Control
Small	2.10	3.03	2.72	1.59
Large	2.51	3.82	2.93	2.01
LSD	0.21	0.24	0.14	0.11

LSD= Least Significant Differences at 5% Level of Probability,

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