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EFFECT OF ORGANIC AND INORGANIC FERTILIZERTREATMENTS ON *Moringa Oleifera* SEEDLINGS LAFIA, NASARAWA STATE, NIGERIA

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ABSTRACT

Effect of organic and inorganic fertilizer treatments on Moringa oleifera seedlings was carried out in Nasarawa State University Keffi, Faculty of Agriculture, Shabu-Lafia campus to evaluate the best fertilizer for Moringa oleifera production. The experiment was laid in a Randomized Complete Block Design (RCBD) and consisted of five treatments which replicated three times each. The results of the experiment indicates that there were no significant differences in the number of leaves and leave area but there were significant differences in Plant height and collar diameter at (p>0.05) on Moringa oleifera seedlings under organic and inorganic fertilizer treatments. The results also showed that Poultry droppings (PD) recorded highest mean value 27.78±0.43cm of plant height which was greater than that of NPK 15:15:15 (27.41±0.24cm). The least mean 22.99±0.92cm was obtained for single super phosphate. For collar diameter4.53±0.25mm was observed as the highest mean value while 3.89±0.20mm of poultry dropping were recorded due to fertilizer application. On the number of leave (10.12±0.60) of NPK was obtained as the larger mean value while (8.42±0.57) was observed for single super phosphate. Leave area had mean value of 11.16±0.96cm^2 for poultry droppings as highest mean value while lowest mean value of 10.06±0.86cm^2 mean was recorded for single super phosphate. This work indicated that poultry droppings gave the best result at 25 gram level of application and therefore recommended for effect Moringa oleifera farming.

Key words: *Moringa oleifera*, seedlings, organic, inorganic, dosage

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INTRODUCION

Moringa oleifera L. (*Moringa pterygosperma* G.), well-known as the "drumstick" or "horseradish" tree, is native of Northwest India, its main producer, but can also be found in South Africa, Northeast Africa, Madagascar, Tropical Asia, Southwest Asia and Latin America. The *Moringa* genus comprises 14 species: *M. arborea*; *M. longituba*; *M. borziana*, *M. pygmaea*; *M. hildebrandtii*; *M. drouhardii*; *M. longituba*; *M. peregrina*; *M. stenopetala*; *M. rivae*; *M. ruspoliana*; *M. Ovalifolia*; *M. Concanensis* and *M. oleífera* (Rani *etal.*, 2018).*Moringa oleifera* gained the title of "Miracle Tree" and commercial attention supported on several properties such as nutritional values, amino acids and flavonols content which can be used in food supplements and cosmetic industry. Compared to other plants, from 100 g of dry leafs of *M. oleifera* is reported to have 7 times more vitamin C than from oranges, 10 times more vitamin A than from carrots, 17 times more calcium than in milk, 9 times more protein than in yoghurt, 15

times more potassium than from bananas and 25 times more iron than the obtained from spinach (Saini *et al.*, 2016).

Nursery operation was carried out from sowing of the seeds to transplanting of the seedlings. An important factor that has direct influence on the quality of the planting stock of moringa is the nature and component of the potting mixture used in the nursery for their production. Inorganic fertilizer is rarely used in Nigeria to raise tree seedlings partly because of its economic cost and partly because it can only supply the specific nutrients it contains to the soil, but cannot provide the additional effects of organic matter for the prevention of erosion, run-off and leaching, improvement of cation exchange capacity and water-holding capacity of the soil. However, these animal manures are at present not easily available in every locality and, where available, their supply is becoming increasingly costly for use in forest nurseries (Fagbenro*et al.,* 2012). *Moringa oleifera* as a fast-growing, deciduous and drought resistant plant can be grown in fields either by direct seeding or through nursery.

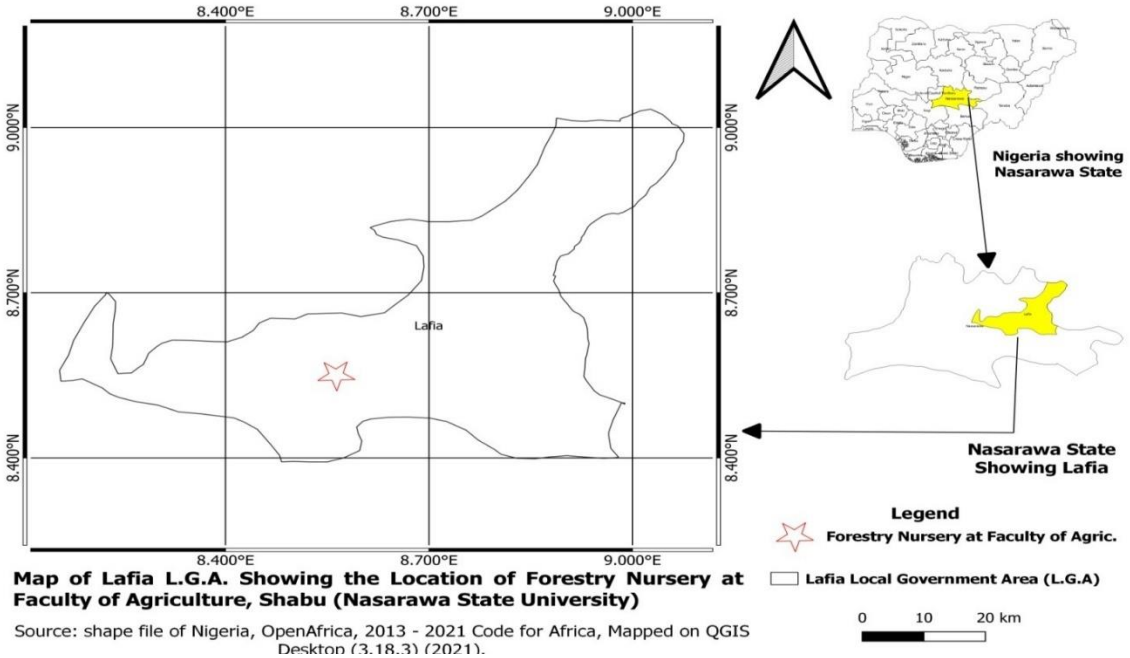
During nursery period, the nutrient amount in the soil should be high enough to sustain the plant growth (Wilson *et. al.,* 2001), and can be periodically increased with doses of organic fertilizers and chemical fertilizers-NPK (Beaulah*et al.,* 2001). In related research, a positive response of *M. oleifera* plants was obtained after fertilizers application (Haouvang*et al.,* 2017). Consequently, the demand for the plant products has been on ascendancy (Imoro*et al.,*2012). However, not much research has been done on its cultivation and fertilization in Nigeria with respect to its growth and productivity using different types of inorganic and organic manures commonly used by local farmers.

Soil fertility is one of the major challengesLafia facing in growth and low yields of *Moringa oleifera*. This happened because the soil fertility of the country differs from one region to another, the nutrients availability in the plant's uptake is very low compare from one region to another, soil in some part of the country have low in organic matter and water holding capacity thereby making the soil prone to soil erosion. Therefore, for good performance of crop production, there is the need to improve the soil fertility through application of organic and inorganic fertilizer amendments.

MATERIALS AND METHODS

Study Area

The study was carried out at the Shabu-Lafia campus of Nasarawa State University's Department of Forestry and Wildlife Management in Lafia. The region is situated at an altitude of 177 m above sea level in the Guinea Savannah Zone of North Central Nigeria, between Longitude 080° 35' N and Latitude 080° 33' E. The range of the average monthly maximum temperature is between 35.06 C and 36.40 C, and the average monthly relative humidity is 74.67%, with 168.90mm of rainfall (Jayeoba, 2013). The study area vegetation is characteristic of Nigeria's Southern Guinea Savannah Zone, which is characterized by tall, short, scattered trees with a grass undergrowth.



Map of Lafia L.G.A. Showing the Location of Forestry Nursery at Faculty of Agriculture, Shabu (Nasarawa State University)

Source: shape file of Nigeria, OpenAfrica, 2013 - 2021 Code for Africa, Mapped on QGIS Desktop (3.18.3) (2021).

Seeds collection and pre-treatment

The seeds for this experiment were collected directly from the mother tree in Lafia metropolis. After collection, the seeds were later subjected to check for viability "provenance test" This was achieved by soaking the seeds into ordinary water for 24 hours in accordance with (Esor*et al*, 2018).

Experimental design

This work consisted a total of five treatmentswhich includes Nitrogen Phosphorus Potassium (N.P.K. 15:15:15), Single Super Phosphate (SSP), Cow dung Poultry and river soil as control. Each treatment replicated 3 times. Wooden suspension was used to raise the seedling above the ground.

Seed sawing and transplanting

Germination beds were constructed at the experimental site of the department Forestry and Wildlife nursery, Faculty of Agriculture Shabu Lafia-Campus, Nasarawa State University, Keffi.A total of 100 treated seeds was sown into germination beds, after which monitoring of sawn seeds was carried out until after six (6) days before recording the first seed emergence, this continuous until after two (2) weeks before the emergence was ceased.Further, two of the matured of the seedlings were transplanted into polythene pot.The transplanted seedlings was allowed to acclimatizefor one week before applying the treatments. A total of 5 treatment were used and these are; Nitrogen Phosphorus Potassium (N.P.K. 15:15:15), Single Super Phosphate (SSP), Cow dung, Poultry droppings and control with each treatment replicated three times.

Data analysis

Data collected on seed germination and growth rate such as plant heights, number of leaves, collar diameter, and leaf area were subjected to descriptive statistics (mean and standard deviation). Inferential statistics (two-way ANOVA) was used (Minitab, version17.00). Where significant differences occurred between the treatments means, the least significant difference (LSD) method was used to separate the means (Aluko *et al*., 2014).

RESULTS

Table 1 shows the effect of organic and inorganic fertilizer treatments on *Moringa oleifera* seedlings in Lafia. The table indicates that there were no significant differences in number of leaves and leave area but there were significant differences in plant height and collar diameter among the fertilizer treatments used on *Moringa oleifera* seedlings. Poultry droppings (PD) the

recorded with highest mean value (27.78±0.43cm) plant height which is greater than that of NPK (27.41±0.24cm) while the least mean (22.99±0.92cm) was for single super phosphate. For collar diameter, (4.53±0.25mm) was observed as the highest mean value while (3.89±0.20mm) of poultry dropping were recorded due to fertilizer application. On the number of leave (10.12±0.60) value of NPK was obtained as the larger mean value while 8.42±0.57 of single super phosphate were observed as the lowest mean value. Leave area had (11.16±0.96cm^2) of poultry droppings as highest mean value while 10.06±0.86cm^2 of single super phosphate was obtained as the lowest mean value.

Table 1: Effect of organic and inorganic fertilizers treatment on *Moringa oleifera* seedlings in Lafia

Parameters	Fertilizer Type				P-value
	CD	NPK	PD	SSP	
Plant Height (cm)	25.10±0.93^{ab}	27.41±0.24^{a}	27.78±0.43^{a}	22.99±0.92^{b}	0.01
Collar Diameter (mm)	4.13±0.13^{ab}	4.53±0.25^{a}	3.89±0.20^{bc}	3.49±0.16^{c}	<0.01
Number of Leaves	9.01±0.68	10.12±0.60	9.41±0.73	8.42±0.57	0.31^{ns}
Leave Area (cm^2)	10.07±0.87	10.71±0.92	11.16±0.96	10.06±0.86	0.79^{ns}

Means on the same row with different superscript are statistically significant (p>0.05); ns = not significant
CD = Cow Dung; NPK = N:P: K; PD = Poultry Droppings; SSP = Single Superphosphate

Table 2 shows the effects of variation by Fertilizer type on *Moringa Oleifera* seedlings in Lafia. The study revealed that there were no significant differences among the number of leaves and leave area in the location but there were significant differences in plant height and collar diameter. The results obtained from Lafia indicated that PD had the highest mean value for plant height (27.78±1.42cm) which was observed higher than that of NPK (27.41±1.24) while the least mean was seen in SSP. Poultry droppings had the highest mean value (11.17±0.96) followed by NPK 15:15:15 (10.72±0.92) whereas SSP recorded the least mean value (10.06±0.86) among the fertilizer in the study area, on the number of leave NPK 15:15:15 had the maximum mean value (10.13±0.60) which is greater than (9.41±0.73) of PD while SSP was observed to have the least mean value. Collar diameter was recorded to have the highest mean value (4.53±0.25) due to effect of NPK while SSP was recorded the least mean value in the location among the fertilizer.

On the varying effect of application level, plant height had the highest mean (28.32±1.58cm) at 30g dosed of application higher than 27.33±1.64cm at 20g dose while control was obtained the least mean. On leave area 13.79±1.80cm^2 was recorded at 25g dose of application followed by 13.79±1.80cm^2 at 30g dosed while control had the least mean value in the study area. For the number of leave, 10.48±0.72 and 10.12±0.81 was recorded to have the greater mean value at 10g and 5g respectively while control had the least mean value among the fertilizer in the study location. On the varying effect of application dosage, collar diameter (4.53±0.30mm) and (4.14±0.31mm) was obtained as the larger mean value at 30g and 25g while the control (0g) had the lowest mean value in the location. The ANOVA result revealed that there were significant differences between plant height, collar diameter, number of leave and leave area in due to varying effect of fertilizer.

For the varying effects of interaction among fertilizer in the study location, plant height got 33.86cm and 33.28cm at 30g and 15g levels of PD application while SSP had the least mean (17.53cm). on leave area cow dung (16.70cm^{2}and (15.30cm^2) at 30g and 25g while PD had the least mean (5.42cm^2) at 25g but for number of leave (12.40 and (11.75) were obtained as the highest mean value at PD 20g and 15g of NPK whereas collar diameter obtained the greater mean 5.15mm at 10g of NPK followed by (5.13mm) of CD (30g) respectively. The result of the ANOVA revealed that there were significant differences among the fertilizer on the varying effect of interaction in the study area.

Table 2: Effects of Variation by Fertilizer Type on*Moringa oleifera* Seedlings in Lafia

Variations	Parameters			
	Plant Height (cm)	**Collar Diameter (mm)**	**Number of Leaves**	**Leave Area (cm^2)**
Fertilizer Type				
CD	25.11±0.93	4.13±0.19	9.01±0.68	10.07±0.87
NPK	27.41±1.24	4.53±0.25	10.13±0.60	10.72±0.92
PD	27.78±1.42	3.89±0.20	9.41±0.73	11.17±0.96
SSP	23.00±0.92	3.49±0.16	8.42±0.57	10.06±0.86
LSD	*3.12*	*0.58*	*1.96^{ns}*	*2.70^{ns}*
ApplicationDosage				
D0=0g	21.97±1.07	3.39±0.21	8.56±0.67	7.41±0.87
D5=5g	25.19±1.56	4.10±0.30	10.12±0.81	11.26±1.13
D10=10g	25.85±1.59	3.80±0.28	10.48±0.72	9.94±0.95
D15=15g	25.27±1.65	4.00±0.25	9.22±0.94	11.17±1.14
D20=20g	27.33±1.64	4.11±0.30	9.29±0.72	11.24±0.94
D25=25g	26.68±1.53	4.14±0.31	9.50±1.72	13.79±1.80
D30=30g	28.32±1.58	4.53±0.30	7.20±1.13	13.79±1.80
LSD	*4.13*	*0.77*	*2.55*	*3.54*
Interactions				
CD X D0	21.99	3.48	10.33	6.04
CD X D5	27.09	4.82	8.56	6.60
CD X D10	27.73	3.69	9.14	10.10
CD X D15	22.10	4.09	8.62	12.04
CD X D20	22.94	3.28	7.33	9.53
CD X D25	25.74	4.48	10.50	15.30
CD X D30	28.14	5.13	5.96	16.70
NPK X D0	23.69	4.17	10.71	9.43
NPK X D5	28.55	4.52	11.14	12.97
NPK X D10	32.12	5.15	10.37	10.39
NPK X D15	23.56	4.22	11.75	9.68
NPK X D20	29.86	5.04	9.22	12.03
NPK X D25	25.50	4.41	9.00	6.60
NPK X D30	28.59	4.22	6.66	8.17
PD X D0	19.93	3.08	11.00	10.37
PD X D5	27.57	3.91	10.75	11.36
PD X D10	20.94	2.86	6.25	10.14
PD X D15	33.28	4.09	9.33	11.47
PD X D20	30.99	4.09	12.40	9.74
PD X D25	27.86	4.17	8.26	5.42
PD X D30	33.86	5.08	8.66	14.04
SSP X D0	22.27	2.86	10.16	5.63
SSP X D5	17.53	3.17	8.60	10.58
SSP X D10	22.62	3.53	8.55	9.26
SSP X D15	22.13	3.62	7.33	10.23
SSP X D20	25.53	4.07	8.00	12.01
SSP X D25	28.20	3.51	8.33	14.67
SSP X D30	22.70	3.72	5.50	11.70
LSD	*8.27*	*1.54*	*5.42*	*7.51*

Means on the same column (for each section) with differences greater than the LSD are statistically significant ($p<0.05$); ns = not significant

DISCUSSION

The results of the findings revealed that poultry droppings appeared to have the great effects from the parameters taken plant heights, collar diameter, leave area and number of leaves. Furthermore, other treatments aside except poultry droppings havemore effects on theseedlings growth than the control. The results indicated that there were no significant differences between number of leaves and leaf area ($p>0.5$) for all the fertilizers used. However, there were significant differences in plant height and collar diameter ($p<0.05$), this result agreed with the work of Aduayi *et al.* (2002). The application of NPK (15: 15: 15) fertilizer significantly increased the vegetative growth of moringa plant. Makinde (2013), reported that the application of NPK fertilizer significantly ($P< 0.05$) increased the vegetative growth of moringa which was also observed from Abdullahi *et al.*,(2013) that the application of poultry manure significantly increased the height and stem girth of *Moringa oleifera*, Yahaya *et el.*,(2016) also reported that average number of leaves per plant tends to increase across all treatments over the weeks irrespective of the fertilizer used.

The variation in growth as a result of cow dung application is similar to the report of Akanbi (2002) and Phan *et al.*, (2002) where the reported that the application of organic manures to soil provides potential benefits including improving the fertility, structure, water holding capacity of soil, increasing soil organic matter and reducing the amount of synthetic fertilizer needed for crop production. Whereas the significant increase in collar diameter of *M. oleifera* seedlings agreed with the work of Adebayo *et al.*, (2011) who reported that the superior performance of cow dung may be due to its higher nitrogen content. Cow dung is a mixture of dung and urine, generally in the ratio of 3:1(Onwudike, 2010). Plant height had the highest mean value $25.10\pm0.94cm^2$ on the application of cow dung, the significant increased were attributed to its growing period which agreed with the finding of (Yahaya *et. el.*, 2016) who reported in their findings that the application of cow dung increased the height of *Moringa oleifera* over the weeks. Therefore, the result of this research proves that the application of cow dung has directly enhanced the growth of *M. oleifera*seedlings.

There is significantly increased on the plant height at ($p<0.05$). Ndubuaku *et al.*, (2015) adopted that poultry manure has significantly plant height at ($p< 0.05$). The highest mean value recorded in the plant height and other parameters of *M. oleifera* was due to the impact of mineral fertilizer. This study agreed with the work of Yaroson *et al., (*2019) who reported that, this is an indication that SSP application at different level of application increases the vegetative growth of the Bambara groundnut and that Bambara groundnut responded to different level of SSP nutrient supplements. The significant increase of the two parameters was an indication that application of SSP greatly affect their growth as opined by (Yaroson *et al.*, 2019).

Inorganic fertilizer had significantly difference in the collar diameter of *M. oleifera* at ($p>0.05$), the changes observed was due to the effect of NPK 15:15:15 fertilizer and this result agreed with the work ofWilliams *et al.*,(2017) who reported that there was a significantly increase in collar diameter of the seedlings grown with the different types of fertilizer. The result also shows that plant height had the highest mean $25.76\pm0.65cm^2$ on the application of NPK 15:15:15: followed by $25.96\pm0.78cm^2$ of poultry droppings while the least mean $24.14\pm0.58cm^2$ was recorded in cow dung application.

CONCLUSION

Moringa oleifera seedlings responded greatly to both organic and inorganic fertilizer application at different levels of application with the poultry droppings has more effects among the fertilizers used at 25gram. Thus, for optimum growth of*Moringa oleifera* farming poultry droppings should be as fertilizer at 25 gram level of application.

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