

Evaluation of *Tithonia diversifolia* and Cattle dung on the Growth of Maize at University of Abuja Teaching and Research Farm

Ojewole, Grace Oluwaseun¹, Pam, Helen David², Joseph, Emmanuel², Idrisu

Muhammad³, Liadi, Muhyideen Tella² & Oyerinde, Akeem Abolade²

¹ *Department of Agricultural Extension and Rural Sociology, Faculty of Agriculture, University of Abuja, Abuja, Nigeria*

² *Department of Crop Protection, Faculty of Agriculture, University of Abuja, Abuja, Nigeria*

³ *Department of Soil Science, Faculty of Agriculture, University of Abuja, Abuja, Nigeria*

Correspondence & Mentor: Oyerinde Akeem Abolade, Department of Crop Protection, Faculty of Agriculture, University of Abuja, Abuja, Nigeria.

Abstract

The study evaluated the effect of *Tithonia diversifolia* Hemsl. A. Gray and Cattle dung on the growth of maize was conducted at the Greenhouse of the Teaching and Research Farm, of University of Abuja. The study was laid-out in a Complete Randomized Design (CRD) with three treatments replicated five times. The treatments *Tithonia diversifolia* extract (3 kg blended and mixed with 2 liters of water applied as foliar spray), Cattle dung powder (air dried and powdered incorporated into the soil) and Water were applied to a maize variety (SAMMAZ 51) planted in pots filled with 20 kg of soil each. The data collected was analyzed using One-way Analysis of Variance (ANOVA). The results showed that the growth rate response to the application of *Tithonia diversifolia* (16.250^c, 247.250^c, 288.750^c, 329.250^c at weeks 3, 7, 9 and 11 respectively) was significantly different from the application of Cattle dung (177.250^b, 221.250^b, 281.250^b) which was significantly better than water at weeks 7, 9 and 11 respectively. The results obtained for leaf length, leaf width and number of leaves followed the same trend indicating that the application of *Tithonia diversifolia* was more effective positively on the vegetative growth of the maize variety. Findings from this experiment indicated that the application of Cattle dung was better than water but not as effective as *Tithonia diversifolia* when used as organic fertilizer. Thus, the use of *Tithonia diversifolia* will be a good source of organic fertilizer that farmer can use to grow maize for efficient growth.

Keywords: Maize, *Tithonia diversifolia*, Cattle dung, Growth rate, Organic fertilizer

1.0 Introduction

Tithonia diversifolia Hemsl. A. Gray, a flowering plant of the family of Asteraceae, (Mexican sunflower) was introduced into West Africa as an ornamental plant. The plant is now observed in the landscape to be invasive and aggressive. On the other hand, it is found to be a great source of biomass for high production of green manure and mulch for soil and landscape protection. It is also reported to be a good plant nutrient source for maize production. The biomass of *Tithonia diversifolia* has low lignin, (6.50%) polyphenol (1.60%) and high nitrogen (3.50%), phosphorus (0.37%) and potassium (4.10%) (Agbede and Afolabi, 2014). This chemical contents show its great potential for use as an organic soil nutrient enhancer. Pena *et al.* (2013) reported that the use of *Tithonia* as a green manure or as a major nutrient source of compost manure for organic crop production helps in high crop yield. Maize (*Zea mays* L.) is a multifunctional crop useful as human food, animal and poultry feed, and in industry for a variety of purposes including maize starch, dextrose, maize syrup, and maize flake (Gul *et al.*, 2021). It grows well in a wide range of soil and climatic conditions. It has high rate of extracting more nutrients than other crops such as tiny grain cereals and grain legumes. According to Ojewole (2023) maize was reported as one of the food crops that enhance food security. After wheat and rice, maize is the third most cultivated crops globally. When there is high production in maize it will help to eradicate food insecurity and create better livelihood. Maize crops consume major nutrients, particularly nitrogen. One major constraint to maize production is poor native soil fertility that needs to be amended with inorganic fertilizer (nutrients) that is in short supply and price out of the reach of the average smallholder farmers in rural Nigeria. The plant nutrient content of *Tithonia diversifolia* indicates it is a very promising organic nutrient source for soil amendment for maize production. Therefore, this study evaluates the effects of phenomenal biomass Accumulator and other indigenous sources such as Cattle dung formulated into organic fertilizer on the growth of maize.

2.0 Materials and Methods

The research was conducted in the greenhouse of the Teaching and Research Farm of the University of Abuja in the Federal Capital Territory (FCT) of Nigeria, Latitude 9.0765° N and Longitude 7.3986° E. The FCT is characterized by two (2) distinct seasons which are the rainy seasons from May to October and the dry season from November to April. Rainfall in this area is Unimodal with its peak in August and sometimes September. The experiment was laid in a Complete Randomized Design with five replicates. There were three treatments namely *Tithonia diversifolia*, Cattle dung and Water (control). The SAMMAZ 51 maize variety obtained from National Agricultural Seeds Council, Abuja was used, *Tithonia diversifolia* biomass obtained from International Institute of Tropical Agriculture (IITA), Abuja while Cattle Dung was obtained from Teaching and Research Farm, Faculty of Agriculture, University of Abuja. Each of the pots perforated at the base (40 cm in diameter and 44 cm deep) was filled with 20 kg of soil. The pots were arranged with an inter and intra row spacing of 50 cm - 50 cm and one meter distance was allowed between the plots, to avoid spray drifts to adjacent plots. Three kilograms (3 kg) of *Tithonia diversifolia* blended and mixed with 2 liters of water, Cattle dungs air dried and powdered and Water were applied as treatments

and each treatment replicated five times. The extract was used as foliar spray. The first dose of the application was done on pots assigned for Tithonia extract by spraying with the extract, 5g of powdered cattle dung was incorporated in each of the pot assigned for cattle dung treatment while water was applied to the five pots allotted for these treatment units before planting. Further application was done three weeks after planting using the same rate and continued fortnightly.

2.1 Data Collection and Analysis

Data were collected on the number of days to germination, number of seedlings that emerged on the first day germination was observed, plant height, number of leaves, length of leaves and width of leaves at weeks 3, 5, 7, 9, and 11. Data collected were analyzed using One way Analysis of Variance (ANOVA) and the mean were separated using the Least Significant Difference (LSD).

3.0 Results and Discussions

As shown in Table 1, the growth rate response to treatments showed no significant differences at weeks 1 and 5, but response to the application of *Tithonia diversifolia* (16.250^c, 247.25^c, 288.75^c, 329.25^c) was significantly different from the application of Cattle dung (177.25^b, 221.25^b, 281.25^b) which was significantly better than water at weeks 3, 7, 9 and 11 respectively. The growth rate responses recorded corroborates earlier report on the use of weeds as soil amendments (Setyowati, 2014).

Table 1: Effect of *Tithonia diversifolia*, Cattle dung and Water (control) on crop growth rate of SAMMAZ 51

Treatment	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11
Cow dung	0.675	1.675 ^a	43.75	177.25 ^b	221.25 ^b	281.25 ^b
Water	1.125	6.750 ^b	42.25	103.50 ^a	112.50 ^a	108.75 ^a
<i>Tithonia diversifolia</i>	1.625	16.250 ^c	120.75	247.25 ^c	288.75 ^c	329.25 ^c
LSD	0.545	1.626	5.650	13.463	15.745	10.231

Means carrying the different superscripts in the same column are significantly different (P<0.05)

Considering leaf length, Table 2 indicates that there was no significant differences among the three (3) treatment at Week 1 in which Cattle dung has (0.125^a), Water (0.250^a) and *Tithonia diversifolia* also has (0.400^a). At week 3 there was no significant difference between Cattle dung (0.350^a) and Water (1.750^b) but there was significant difference on *Tithonia diversifolia* (5.250^b) compared to others. At Week 5 there was no significant differences between Cattle dung (21.25^a) and Water (26.25^a) but the application of *Tithonia diversifolia* (62.00^b) was significantly different. Weeks 7 and 9 also followed the same trend by not having any significant differences between Cattle dung

and Water, but *Tithonia diversifolia* significantly influence the growth of SAMMAZ 51. At Week 11 the result shows Cattle dung (94.00^b) was significantly different from Water (37.75^a) and *Tithonia diversifolia* (108.25^c) was the most effective in terms of leave length. This is in line with the report of Bueren *et al.* (2011) who reported that the foliar application of *Tithonia diversifolia* has effect on the growth of crops.

Table 2: Effect of *Tithonia diversifolia*, Cattle dung and Water (control) on Leave Length of SAMMAZ 51

Treatment	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11
Cow dung	0.013	0.350 ^a	21.250 ^a	52.750 ^a	56.500 ^a	94.000 ^b
Water control	0.250	1.750 ^a	26.250 ^a	52.250 ^a	47.500 ^a	37.750 ^a
<i>Tithonia diversifolia</i>	0.400	5.250 ^b	62.000 ^b	88.750 ^b	100.500 ^b	108.250 ^c
LSD	0.150	0.930	3.930	5.530	4.430	5.220

Means carrying the different superscripts in the same column are significantly different (P<0.05)

On the width of leaves, Table 3 shows that at Week 1 there was no significant difference between the application of Cattle dung (0.100^a) and Water (0.125^a), but the application of *Tithonia diversifolia* (1.375^b) had significantly higher leave width. Results at Weeks 3, 5, 7, 9 and 11 followed the same trends indicating that the application of *Tithonia diversifolia* was the most effective. The results obtained in the experiment was in support of Haytova, (2013) who reported that the effectiveness of foliar fertilizer is determined by the crop species, fertilizer form, concentration, frequency of application and the stage of plant growth.

Table 3: Effect of *Tithonia diversifolia*, Cattle dung and Water (control) on Width of leaves of SAMMAZ 51

Treatment	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11
Cow dung	0.100 ^a	0.500 ^a	2.250 ^a	4.500 ^a	5.950 ^b	7.500 ^b
Water	0.125 ^a	0.975 ^a	2.200 ^a	5.900 ^a	4.250 ^a	4.650 ^a
<i>Tithonia diversifolia</i>	1.375 ^a	1.950 ^b	6.750 ^b	7.875 ^b	8.950 ^c	9.625 ^c
LSD	0.307	0.383	0.774	0.680	0.597	0.968

Means carrying the different superscripts in the same column are significantly different (P<0.05)

Table 4 shows that at week 1, no significant difference recorded in the number of leaves among the three treatments, but week 3 result followed a different trend reflecting a significant difference between *Tithonia diversifolia* (4.25^b) and the remaining treatment, Cattle dung (2.50^a) and Water (2.50^a). Results at weeks 5, 7, 9 and 11 followed the same effective trends indicating that *Tithonia diversifolia* was more effective on number of leaves than Cattle dung and water. This finding conforms to earlier reports in Africa that biomass has positive effect on growth performance of rice, maize and other vegetative crops (Jama *et al.*, 2000; Olabode *et al.*, 2007; Devide, 2013.)

Table 4: Effect of *Tithonia diversifolia*, Cattle dung, Water (control) on the Number of leaves SAMMAZ 51

Treatment	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11
Cow dung	2.000	2.500 ^a	5.250 ^a	8.000 ^a	10.250 ^a	13.500 ^a
Water control	2.000	2.500 ^a	2.750 ^a	7.250 ^a	11.750 ^a	16.250 ^a
<i>Tithonia diversifolia</i>	2.250	4.250 ^b	13.250 ^b	21.500 ^b	24.250 ^b	25.750 ^b
LSD	0.204	0.612	1.495	1.486	1.736	2.409

Means carrying the different superscripts in the same column are significantly different (P<0.05)

4.0 Conclusion

Tithonia diversifolia is a plant with high plant nutrient component and could be used to enhance soil fertility. The improvement of growth parameters in SAMMAZ 51 in this experiment portrays *Tithonia diversifolia* as a potential bio-fertilizer that can be adopted for growth of maize in the Federal Capital Territory (FCT), Abuja, Nigeria.

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References

- Agbede, M. T. and Afolabi A. L. (2014). Soil fertility improvement potentials of Mexican sunflower (*Tithonia diversifolia*) and Siam weed (*Chromolaena odorata*) using okra as test crop. *Arch. Appl. Sc. Res.* 6 (2): 42-47
- Bueren. L.E.T., Jones, S.S., Tamm, L. Murphy, K. M. Myers, J.R. Leifert, C. and Messmer, M.M. (2011). The need to breed crop varieties suitable for organic farming, using wheat, tomato and broccoli as examples: A review *Wageningen Journal of Life Sciences* 58:193-205.
- Devide, A. C. P. (2013). Adubos verdes para sistemas agroflorestais com guanandi cultivado em varzea e terraço fluvial. Univ. Fed. Rio de Janeiro, *Rev. de Lit. Dout. Curso Pos-grad. Fitotecnia*, 1-29.
- Gul, H., Rahman, S., Shahzad, A., Gul, S., Qian, M. and Xiao, Q. (2021). Maize (*Zea mays* L.) Productivity in response to nitrogen management in Pakistan. *American Journal of Plant Science.* 12, 1173-1179.
- Haytova, D. (2013). A Review of Foliar Fertilizer of Some Vegetable Crops. *Annual Revised and Resources in Biology.* 4:455-465.
- Jama, B.A., Palm, C.A., Buresh, R.J., Niang, A.I., Gachengo, C., Nziguheba, G. and Amadalo, B. (2000) *Tithonia diversifolia* as a green manure for soil fertility improvement in western Kenya: a review. *Agrofor. Syst.* 49:201–202.
- Ojewole, G.O. (2023). Women Participation in Household Food Security in Ogbomoso South Local Government Area, Oyo State, Nigeria. *Journal of Agriculture and Education Research.* 1(1):1-9.
- Olabode, O. S. Sola, O. Akanbi, W. B. Adesina, G. O. and Babajide, P. A. (2007). Evaluation of *Tithonia diversifolia* (Hemsl.) A Gray for soil improvement. *World Journal Agricultural Sciences.* 3 (4): 503-507.
- Pena, C.D., Leah, I. B. and Tules, P. B. (2013). The potential of *Tithonia diversifolia* (wild sunflower) as organic foliar fertilizer. *European Scientific Journal.* 4: 465-468.
- Setyowati, N. (2014). Weed Sourced Organic Fertilizer for Vegetable Production in Closed Agriculture System in Humid Tropical Highland of Bengkulu. *Proc. 5th RENPER. International Seminar*, October 22-24, Banking University Ho chi Minh City, Vietnan.