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The Analysis of Phosphate Ions in *Tithonia diversifolia* (Wild Sunflower) Used as Composite Manure

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Tithonia diversifolia, Wild Sunflower, Phosphates, and Composite.

A B S T R A C T

Inorganic fertilizers have been a greater threat to soil structure and vegetables that are consumed by human being. *Tithonia diversifolia* is a plant that grows locally or can either be planted to be used in making of manure due to its high level of Nitrogen, potassium, and phosphates. In this research, phosphate ions were analyzed in order to ascertain the effectiveness of *Tithonia diversifolia*. An Ultraviolet-visible spectroscopy was used to determine the wavelength of the phosphates in *Tithonia diversifolia*. Baraton University research farm widely use *Tithonia diversifolia* when making their composite manure. The research showed that there is a significant amount of phosphates in the plant from both the sample areas. The phosphates absorbance was in the range of 0.593 to 0.777. Organic manure has therefore been widely recommended as the best to grow vegetables and even maize.

Introduction

Tithonia diversifolia, commonly known as Mexican or wild sunflower, is a shrub belonging to the family of Asteraceae. Green biomass of *Tithonia* has been recognized as an effective source of nutrients. Manures and composts can provide significant quantity of nutrients and have a constant effect on the soil for a long time

T. diversifolia green biomass is an effective source of nutrients and has been used successfully to improve soil fertility and crop yields in Kenya (Jama *et al*., 2000). *Tithonia* accumulates large amounts of nitrogen and phosphorus from the soil and when cut and incorporated into the soil, it releases nearly all its nitrogen to the soil very quickly, even though it's not a legume (Gachengo, 1999). This makes it an important source of nutrients and organic matter for soil rejuvenation (Jama *et al*., 2000).

The reported uses of *Tithonia* includes fodder (Anette, 1996; Roothaert and

Patterson, 1997; Roothaert *et al.*, 1997), poultry feed (Odunsi *et al.*, 1996), animal feed (Olayeni, 2006), compost (Drechsel and Reck, 1998; Ng'inja *et al.*, 1998), land demarcation (Ng'inja *et al.*, 1998), soil erosion control (Ng'inja *et al.*, 1998), building materials and shelter for poultry (Otuma *et al.*, 1998).Composted organics has other beneficial effects, including diverting landfill wastes to alternative uses, removal of pathogen inocula or weed seeds and decomposition of petroleum, herbicide or pesticide residues, and erosion control and as a nutrient source for sustainable re-vegetation of degraded soils. Compost fertilizer is made from plant and animal remains with the objective of recycling plant and animal remains for crop production.

The potential of *Tithonia diversifolia* as a green manure has been reported more from Kenya than other African countries. Palm (1995) observed that it was possible to produce 2 mg maize $ha^{-1}$with an application of 5 tha^{-1} of *T. diversifolia*green manure. This maize yield was similar to that obtained when 60 kg Nha^{-1} as diammonium phosphate was used. However, the real advantage of *T. diversifolia* may come from its apparent ability to make soil P more available to plants. An available soil P could be increased in the same measure when the same rate of is supplied using *T. diversifolia* alone or in combination with 15 kg TSP ha^{-1} (Nziguheba *et al.*, 1998)

In Kenya and South East Asia small holder farmers use *T. diversifolia* for fertility improvement. *Tithonia* leaves contain 3.5, 0.37 and 4.1 % N, P and K respectively and decomposes quickly after incorporation into the soil and is an effective source of fertility (Gaghenco *et al*., 1999). Soil fertility benefits are greater for green biomass rather than dried (Otuma *et al.*, 1998).

Tithonia improved available soil P and P uptake by maize on acid soils of Northern Zambia (Malama, 2001). *Tithonia* appeared to enhance P availability on these P-fixing soils. Stover and grain yields were improved by the incorporation of *Tithonia* (Malama, 2001). *Tithonia* improved soil fertility and maize yield, alone or in combination with single superphosphate or ground rock phosphate. It is a cheap effective method of ameliorating soil acidity in Northern Zambia (Malama, 2001).

Tithonia as an effective source of biomass for annual crops has been reported for rice (Nagaraj and Nizar, 1982) and it has been annual, aggressive weed growing to a height of about more recently reported as a nutrient source for maize in Kenya, Malawi and Zimbabwe (Jama *et al.*, 2000). In integrated soil fertility management, organic materials such as *Tithonia* are usually broadcast and incorporated at planting time. Such organic materials can reduce P-fixation and increase P availability (Nziguheba *et al.*, 1998 and 2000).

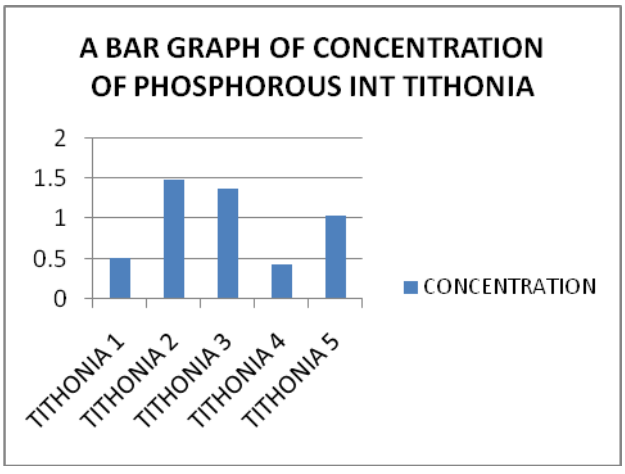
Compost fertilizer is made from plant and animal remains with the objective of recycling for crop production. The decomposition process converts potentially toxic or put risible organic matter into a stabilized state that can improve soil for plant growth. Compost fertilizers can be used as mulch, for weed control as well as soil fertility improvement (Roe *et al.*, 1997). This study was carried out to the analysis of phosphate ions in *Tithonia diversifolia* (wild sunflower) used as composite manure.

Materials and Methods

The green plant of *Tithonia Diversifolia* was picked from the Baraton university research farm from different locations of the same farm. It was dried under roof for one month.

Digestion of the sample was done by weighing 1g of the dried ground sample into a 150 ml beaker and 5ml of nitric acid was added into the beaker for digestion. The sample was held for about 12 hours to digest fully. A hot plate was used to evaporate the solvent while adding hydrogen peroxide (2 ml at intervals) until a white ash was formed. The standard solution was made from dried monopotassium phosphate (2.1969g was diluted with distilled water to make a 500ml of the solution). And20, 40, 60 and 80 mg P L-1 was prepared by pipetting 2, 4, 6, and 8 ml of the monopotassium phosphate solution. In color development, both the samples and the standards were diluted to the working solution (20ml of molybdate solution and 10ml of ascorbic acid diluted to 1 L) to the ratio of 1:100. The blue color developed after 30 minutes. UV absorbance was read at 660 nm and concentrations were calculated. [Nitric acid was used for wet ashing. An acid molybdate solution and ammonium molybdate solution were also used in this analysis. Ascorbic acid and standard solution of monopotassium phosphate, antimony potassium tartrate were used to make the working solution]. Microsoft excel was used to tabulate the results, both the table and bar graph.

SAMPLE	CONCENTRATION
TITHONIA 1	0.514
TITHONIA 2	1.486
TITHONIA 3	1.374
TITHONIA 4	0.436
TITHONIA 5	1.034



Results and Discussion

The positive impact from growing *Tithonia* on soil fertility, especially the phosphorous status, is supported by the reports of (Phiri *et al*., 2001). *Tithonia diversifolia* has a high potential for the rapid restoration of fertility in degraded soils by increasing the plant available phosphorous. The differences in the concentration of the samples of *Tithonia* were due to the places where the samples were picked from. *Tithonia* 2, *Tithonia*3 and

Tithonia 5 have higher concentrations which might have been due to the surface runoff from the farm where other phosphate fertilizers were used.

According to Shokalu *et al.,* (2010), compost and *Tithonia* green manure can be used to improve crop yield and promote sustainable food production by improving soil properties. Composting also improves the quality of materials of soil amendments. Compost and *Tithonia* at 10 tons $ha^{-1}$is recommended.

The occurrence of very high N, P and K concentration in *Tithonia* compared to other organicmatter sources is in agreement with the findings of Generose *et al.,* (1980) that *Tithonia* is a high quality organic source in terms of nutrient release and supplying capacity.

Soil temperature is reduced Tithonia mulch, this is a confirmation of the work carried out by Adeniyan *et al*., (2008) and Akanbi and Ojenyi (2007) where *Tithonia* and siam weed increased organic matter; N, P, K, Ca, Mg and reduced soil temperature, bulk density, increased soil moisture content, leaf N and K, growth and tuber yield of yam at Akure, Southwest Nigeria.

The research showed that there is a significant amount of phosphates in the plant from both the sample areas. Hence, organic manure can be used to grow vegetables and even maize.

Conclusion

Tithonia diversifolia with its high nutrient status is a potential soil improver for enhanced productivity. The plant is recommended for use as a green manure or as a major component of compost manure. Dried *Tithonia* plants should also be preferably left to decompose on the field rather than burning them.

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