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Effect of soil amendments on growth, minerals and proximate composition of *Launaea taraxacifolia* (Willd.) Amin Ex C. Jeffrey

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Abstract
Launaea taraxacifolia is a rarely consumed vegetable in a few countries of Africa where it is cultivated. It is mostly restricted in range to the wild. It is indigenous and largely uncultivated in Nigeria due to cultural inhibition and lack of information on its dietary benefits. Knowledge of its minerals and proximate contents under various soil amendments would enhance its consumption in southwest Nigeria. Field assessment of response of *L. taraxacifolia* to soil amendments was carried out at Atiba Local government area (LGA), Oyo State, Nigeria in the rainy season of 2015. Number of leaves produced and mean leaf areas (cm^2) of *Launaea taraxacifolia* to poultry manure, cattle dung at the rate of 2 t/ha and urea (200kg/ha) were assessed in a completely randomized design with five replicates. Data were analysed using analysis of variance. Means that were significant were separated using Duncan's Multiple Range at P=0.05.*Launaea taraxacifolia* performed better on Urea fertilized plots better than in plots supplied other amendments and control. There was no significant difference in number of leaves and leaf area of *Launaea taraxacifolia* in plots amended with cattle dung or poultry manure. The vegetable had significantly ($P<0.05$) highest ash (2.30%), fat (2.10%), carbohydrate (77.62%) and energy content (338.38 Kcal/J) in plots amended with cattle dung. The study indicated that the perforamnce of *Launaea taraxacifolia* under synthetic and organic soil amendments was comparable.

Keywords: *Launaea taraxacifolia*, wild vegetables, soil amendments, proximate composition

INTRODUCTION

Vegetables are important components of a healthy diet, and their sufficient daily consumption could help prevent major diseases and many health disorders as they contain different antioxidant components. Vegetables promote intake of essential nutrients from

other foods by making them more palatable (Ruel *et al.,* 2004). The phytochemicals and micronutrients profiles of vegetables vary with species, climate, and geographical condition (Gupta *et al*., 2006). It is therefore essential to estimate and document the nutritional and phytochemical of traditional vegetables along with their antioxidant activity. Although investigations are being conducted on medicinal plants, but scanty database is available on nutritional and phytochemical profile of traditional vegetables consumed by local people in West Africa (Adebisi *et al.,* 2000).

Applications of mineral and organic fertilizers are the two common ways in which sustainable agriculture is done (Geier, 1997). Poultry manure contains high percentage of nitrogen and phosphorus for the healthy growth of plants (Ewulo, 2005). Nitrogen is an essential element for plant growth and development (Cheng-Wei Liu *et al.,* 2014). Organic matter is the ultimate determinant for sustainable soil fertility in most tropical soils (Ikpe and Powel, 2002). Inorganic fertilizers are safe to use and release nutrients to the plants quickly, albeit, their constant use has negative impact on the soil (Stolton, 1997). Urea fertilizer contains mainly 46% nitrogen which enhances vegetative growth in plants. This unique characteristic is good for vegetable crops with edible leaves, stems and roots (Olubunmi *et al.,* 2011).

Launaea taraxacifolia commonly known as African Lettuce belong to the family Astreceae. In Nigeria, Yoruba tribe calls it "Efo-Yanrin", ''Ugu" among the Ibos of the Eastern part of Nigeria while Hausa tribe calls it "Namijindayii (Adebisi, 2004; Arawande *et al.,* 2013). It is an erect, rhizomatous annual or perennial herb, with grayish blue bloom. It has an erect stem up to about 1 – 3 meters high from a woody rhizome which is solitary branched and borne with 25 – 30 floret flowers with yellow corollas in a convex receptacle at the apex slightly narrowed, which produces a white 7 – 8 mm long pappus air-borne seeds. The leaves developed from the base in a rosette form or alternate position capped by golden yellow flowers. The leaves have deeply cut lobes that are repand at margins. All the leaves are smooth and waxy, about 25 cm long and 5 – 10 cm wide (Burkill, 1985; Akobundu and Agyakwa, 1998; Sakpere *et al.,* 2008).

Vegetative propagation is the best for its production using the roots rhizomes because the seed germination percentage is very low and getting the pappus or seeds from the fruits is a cumbersome process. Rhizomes are cut in pieces of about 10 cm length and these are planted horizontally and entirely covered with soil; 30–50 cuttings may be planted in a bed of 10 m^2. Rhizomes sprouted within 10 days. The sprouted rosettes bolts in about 56 Days after planting (DAP) and seeds are formed in about 70-75 DAP. Schippers (2000) and Sakpere *et al*. (2008) reported that shoot brancing is as low as 17%.

Launaea taraxacifolia does not need much management because of its low water requirement. The best time for the harvest appears to be between the 6th and 8th weeks after planting (Sakpere *et al*., 2008). Once the plant has developed and starts producing leaves, regular harvesting is recommended

as the consistent harvesting promotes the production of new leaves while, delaying facilitated initiation of flowering, which negatively affects the quantity and quality of the leaves formed. Little is known about the plant's response to manure and mineral fertilizer application. Organic manure encourages production of quality leaves under irrigation.

The usefulness of this plant is not limited to consumption, even though, some people believes that its frequent consumption reduces spiritual power. It is used to revive snake spit blindness. Also, it is used as febrifuge and remedy for many aliments. *Launaea taraxacifolia* is rarely used as a leafy vegetable in Nigeria, except when there is scarcity of other vegetables, albeit, it is used as livestock feed (Adebisi, 2004; Sakpere *et al.*, 2008).

There is scanty information on the effect of soil amendment on growth and proximate composition of *Launaea taraxacifolia* .Therefore this study was carried out to investigate the effect of urea fertiliser, poultry manure and cattle dung on growth, nutrient uptake and proximate constituents of *Launaea taraxacifolia* in Ibadan southwestern Nigeria.

MATERIALS AND METHODS

Study Area

The study was conducted at the Crop garden of Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan, Nigeria on Latitude N 7° 27`04.9`` and Longitude E 3° 53`49.1`` on elevation of 198 m. The study site is located in rainforest agroecological zone with a mean annual rainfall of 1,154 mm, mean annual temperature of 27°C and mean monthly relative humidity of 75% over 50 years (NIMET, 2012).

Soil collection, manure application and planting

Five kilogram top soil collected from the Crop garden of Department of Crop Protection and Environmental Biology, University of Ibadan was put in each experimental bag of dimension 35 cm x 30 cm. Soil in each bag was pre-treated before application with soil amendments: Urea (200 kg/ha), Poultry manure (2 t/ha), Cattle dung (2 t/ha or 5 g per 5 kg soil) following recommendations of Awodun (2007) and Cheng-Wei Liu *et al.* (2014), and Control (No amendment);. There were four treatments which was laid out in a completely randomized design (CRD) with five replicates.

Rhizomes of *Launaea taraxacifolia* used were collected from Ayetoro village in Oyo town, Oyo State, Nigeria. They were cut into 10 cm lengths and planted in nursery consisting of 5 kg soils per bag for two weeks. Uniformly sprouted seedlings were transplanted into the arranged pots in the field. The manures and Urea were applied two weeks before transplanting and two weeks after transplanting (WAT), respectively. Growth parameters of the plant were taken at 4, 6, 8, and 10 WAT. Weeding and watering were done as needed to ensure all pots were under similar conditions.

Data Collection

Data were collected at 4, 6, 8, and 10 WAT on number of leaves using visual count, leaf area with graduated graph sheets, plant height with a meter rule and tape rule and stem girth using vernier caliper. Leaf area was estimated using a linear regression formula derived from the relationship of its leaves length and corresponding area obtained from graph as Y= 2.58x – 9.968,

where Y and x are area and length of leaf, respectively.

Determination of soil physico-chemical properties; the nutrients and proximate composition of soil amendments after harvest

The physicochemical properties of the top soil and manures used were determined at the soil analytical laboratory of Department of Agronomy, University of Ibadan following the procedures of A.O.A.C. (2003). Nutrient (K, Na, Mg and Fe), Proximate (percentage moisture content, dry matter, ash, crude protein, crude fibre, fat and carbohydrate) compositions of *Launaea taraxacifolia* were determined at four and ten weeks after transplanting following the standards procedures of Association of Official Analytical Chemists A.O.A.C. (2003).

(**Data analysis:**

Analysis of variance (ANOVA) was conducted using DSAASTAT, version 1.0. It was used to analyse the growth, nutrient uptake and proximate constituents of the crop. Significant means were separated using Duncan's Multiple Range Test at $P \leq 0.05$.

RESULTS

The top soil used was slightly acidic, with a C:N ratio good for mineral uptake. It is moderately high in Total phosphorus and calcium, but low in magnesium, potassium and sodium. The values of micro nutrients in the soil were adequate in micro nutrients, with a loamy sand textural class. It was in texture (Table 1). Poultry manure used contained higher anounts of macro and micro nutrients than cattle dung, especially, total nitrogen, total phosphorus, potassium and sodium; and likewise in iron and Zinc (Table 2).

Table 1: Physiochemical contents of topsoil of Crop garden, poultry manure, and cattle dung used to assess the growth of *Launea taraxacifolia* in 2015

PARAMETERS	SOIL	POULTRY MANURE	CATTLE DUNG
pH	6.46	-	-
T.O.C (g/kg)	40.59	-	-
Total N(g/kg)	3.96	2.63%	1.78%
Total P (mg/kg)	29.62	0.46%	0.44%
Ca (cmol/kg)	2.68	1.84%	3.61%
Mg (cmol/kg)	0.59	0.77%	1.27%
K (cmol/kg)	0.31	1.28%	0.71%
Na (cmol/kg)	0.46	0.61%	0.53%
Fe (mg/kg)	73.00	3105.0	2055.0
Cu (mg/kg)	1.22	156.0	174.0
Mn (mg/kg)	85.00	317.5	505.0
Zn (mg/kg)	1.68	211.0	110.5
C:N Ration	10.25		
% Clay	9.4	-	-
% Silt	7.4	-	-
% Sand	83.20	-	-
Textural Class	Loamy sand	-	-

Table 2: Mineral Composition of *Launaea taraxacifolia* at 6 and 12 weeks after transplanting in Ibadan in 2015

	6 Weeks				12 Weeks			
TREATMENT	K (mg/kg)	Na (mg/kg)	Mg (mg/kg)	Fe (mg/kg)	K (mg/kg)	Na (mg/kg)	Mg (mg/kg)	Fe (mg/kg)
CONTROL	8500b	310b	440c	130a	3180c	180b	450d	3045b
CATTLE DUNG	8500b	330c	430b	240c	5010d	260c	360c	5240d
P.MANURE	2950a	450d	380a	260d	2620b	150a	340b	4860c
UREA	10500c	260a	460d	170b	1550a	270d	300a	795a

Launaea taraxacifolia produced more leaves at 6, 8, and 12 WAT respectively. The leaves as economic components of yield were larger under urea application at 8, 10, and 12 WAT respectively (Figure 1). The soil amendments did not produce any significance difference in the number of leaf across the treatments including the control except at twelve weeks where control had the least (Figure 2).

Many minerals in *Launaea taraxacifolia* reduced from 6WAT and 12WAT in the leaves (Table 3). In the control, K reduced from 8500 mg/kg to 3180 mg/kg, Na from 310 mg/kg to 180 mg/kg; cattle dung K from 8500 mg/kg to 5010 mg/kg, Na from 330 mg/kg to 260 mg/kg; poultry manure, K from 2950 mg/kg to 2620 mg/kg, Na from 450 mg/kg to 150 mg/kg, urea, K from 10500 mg/kg to 1550 mg/kg. The amounts of minerals accumulated under the four treatments were significantly different from one another at 6WAT and 12 WAT However, the value increased in Fe (Table 3).

Poultry manure stimulated higher proximate contents in the vegetable at 6 WAT (Table 3). Percentage crude fibre and fat were not significantly different in all treatments. However, at 12 WAT, cattle dung stimulated the highest content in dry matter (87.87%), ash (2.30%), fat (2.10%), carbohydrate (77.62%) and energy (338.38 Kcal/100g), followed by urea, and poultry manure application (Table 4).

Table 3: Nutrients Composition of *Launaea taraxacifolia* at Six Weeks after transplanting in Ibadan in 2015

TREATMENT	MOISTURE (%)	DRY MATTER (%)	ASH (%)	C.PROTEIN (%)	C.FIBRE (%)	FAT (%)	CARB. (%)	ENERGY (%)
CONTROL	18.69a	81.31d	15.14b	21.01b	1.11a	0.83a	61.91c	339.15d
CATTLE DUNG	21.07c	78.93b	20.53d	22.75c	1.08a	0.80a	54.84a	317.56c
P.MANURE	21.85d	78.15a	16.6c	24.50d	1.12a	0.87a	56.91b	260.84a
UREA	19.48b	80.52c	14.52a	14.25a	1.49a	0.91a	68.83d	274.17b

Means with the same letter down the column are not significantly different

Table 4: Nutrients Composition of *Launaea taraxacifolia* at Twelve Weeks after transplanting in Ibadan in 2015

TREATMENT	MOISTURE (%)	DRY MATTER (%)	ASH (%)	C.PROTEIN (%)	C.FIBRE (%)	FAT (%)	CARB. (%)	ENERGY (%)
CONTROL	22.10d	77.90a	1.90a	12.25b	3.80ab	1.70a	57.25b	297.30a
CATTLE DUNG	12.13a	87.87d	2.30a	2.25a	3.60a	2.10a	77.62c	338.38d
P.MANURE	18.01c	81.99b	2.15a	20.38d	4.10b	1.80a	53.56a	311.96b
UREA	14.89b	85.11c	2.00a	18.625c	4.70c	1.90a	57.88b	323.14c

Means with the same letter down the column are not significantly different

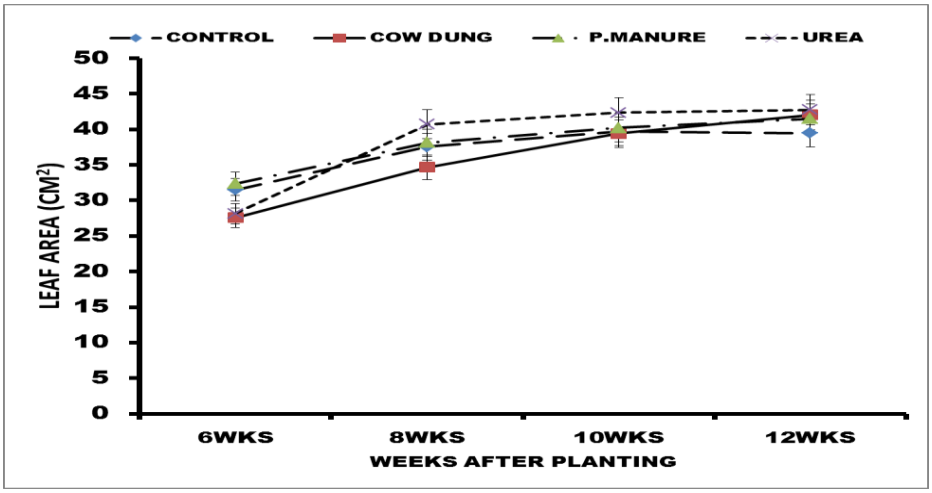

Figure 1: Response of leaf areas of *Launea taraxacifolia* to soil amendments in Ibadan in 2015

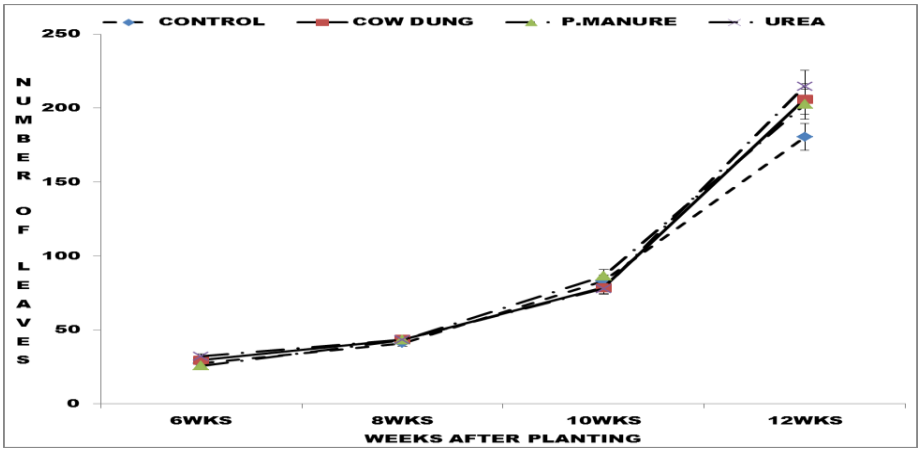

Fig. 2: Response of number of Leaf of *Launea taraxacifolia* to soil amendments in Ibadan in 2015

DISCUSSION AND CONCLUSION

Response of *L. taraxacifolia* to the soil amendments is variable, but urea stimulated higher growth in the consumed and economic parts of the vegetable, such as number of leaves and leaf area; although the influence of other amendments were statistically close to what was observed in urea. This is in consonance with Ehaliotis *et al* (2010) who reported that nitrogen fertilizers increase productivity of vegetables.

Inorganic fertilizers release their nutrients to plants fast, but overtime, the slow and long lasting release of nutrients by organic manure helps crops till maturity, as observed in poultry manure and cattle dung stimulating higher mineral contents in the vegetable, especially at 12 WAT. Thus, the consumption of the *L. taraxacifolia* will help in proper functioning of the intracellular and extracellular of the bodies which are aided by sodium and potassium that regulate volume of plasma, balance of acid-base, contraction of nerve and muscle (Akpanyung, 2005).

The carbohydrate of bitter leaf, scent leaf, *Telfairia occidentale*, and *Amaranthus candatus* vegetables is lower than that of *Launaea taraxacifolia*. Its fat and fibre are lower than those found in bitter leaf, scent leaf, *Telfairia occidentale*, and *Amaranthus candatus* vegetables (Asaolu *et al*., 2012). The high value of its carbohydrate, ash; and low value of its ash supports the work of Arawande *et al*., (2013). This means that aside other advantages, *Launea taraxacifolia* compares favourably with known vegetable of choice in southwestern Nigeria

Regular intake of *Launaea taraxacifolia* will help to reduce the intake of starchy food, enhances gastrointestinal function, prevents constipation and may reduce the incidence of metabolic diseases like aging, diabetic mellitus among others. *Launaea taraxacifolia* energy value was 260.84 – 339.00 Kcal/100g was within the range that Arawande *et al*. (2013) reported for some common vegetables in the tropics.

Launaea taraxacifolia was positively responsive to soil amendments. The proximate contents of the vegetable were stimulated in early in the crop life by poultry manure, but later by cattle dung, followed by Urea, to support BVG (2010) that cattle dung encourages mineralization and faster nutrient release to the plant overtime.

This study reavealed that *Launaea taraxacifolia* as an indigenous vegetable could help alleviate hidden hunger, hence its deliberate cultivation and consumption is encouraged. In order to overcome biological limitation to cultivation of *Launaea taraxacifolia*, plant breeders need to enhance its low seed germination percentage (Schippers, 2000; Sakpere *et al.*, 2008).

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