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Effects of Mulching and Trellising On the Performance of Different Land Races of Fluted Pumpkin (Telfairia Occidentalis)

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Abstract
Two soil and crop management practices (mulching and trellising) were evaluated to assess their effects on the performance of 3 landraces of Telfaria occidentalis (fluted pumpkin). Mulching with dry guinea grass and trellising with wooden sticks were combined with 3 landraces of T. occidentalis (Ogoni, Ngwa and Iriebe) to give 12 treatments combinations, replicated 3 times in a 2 x 2 x 3 factorial experiment; fitted into a randomized complete block design. The parameters collected were seedling emergence, vine length, number of leaves, fresh and dry leaf yeld. Mulching negatively affected seedling emergence for the 3 landraces, although not significant at the level of probability used ($P<0.05$). mulching and trellising improved number of leaves and fresh leaf weight for the Ngwa (263.3 and 173kgh^{-1}) and Iriebe (171.3 and 135kgh^{-1}) landraces, respectively. The fresh weight yield of the landrace alone was in the order 136 > 116.4 > 104.5kgha^{-1} for Ngwa, Iriebe and Ogoni, respectively. Mulched and trellised Ngwa landrace gave a significant higher number of leaves and fresh weight when compared with all the other treatments. This was followed by the Iriebe landrace. This suggests that these two landraces are better adapted to the terrain of the experimental location.

Key Words*: Telfaria occidentalis, mulching, trellising, landraces*

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I. Introduction

Telfairia occidentalis is a tropical vine crop belonging to the family cucurbitaceae and it is native to West Africa (Akoroda 1990). Common names for the plant include *fluted gourd, fluted pumpkin, ugu*. It is grown as a leaf vegetable and for its edible seeds. the seeds produced by the gourd are high in protein and fat, and can, therefore, contribute to a well-balanced diet. Considered an “oil seed”, the fluted gourd has oil content as high as 30% (Akoroda 1990). Shoots of *T. occidentalis* contain high levels of potassium and iron, while seeds are composed of 27% crude proteins and 53% fats (Aiyeaagbe and Kintomo 2002) The leaves contain a high amount of antioxidants and hepatoprotective and antimicrobial properties. The leaf has a high nutritional, medicinal and industrial values being rich in protein (29%), fat (18%) and mineral and vitamin (20%) (Aletor, *et al*, 2002, Akanbi *et al*, 2007).

The plant is a drought-tolerant, dioecious perennial crop, usually propagated by seed and can grow up to 15 m long. It is a harden crop could survive under unfavorable conditions such as low fertility, drought, high soil temperature, and weed infestation (Udoh *et al*, 2005). The succulent tasty leaves and stems, and nutritious seeds make it the most popular vegetable to millions of people. Hence, rank as one of the most three widely eaten vegetable at home and restaurant across Nigeria.

Mulch is a protective material used in covering the soil surface in order to minimize evaporation. Mulching effectively insulates soils from extreme temperature by preventing excessive heating during the day, thereby conserving soil moisture, and enhances crop production through soil and water conservation, and weed control. Thus, improve soil physical and chemical properties (Salau *et. al.*, 1992, Mbonu and Elenwo 2006, Ni *et. al.*, 2016, Orji and Eke 2018). Besides controlling weeds, mulch conserves the soil water, certain soil insects and millipedes may also develop large population when grass mulches are applied (Olaniyi and Ajao 2011)

Trellising is the act of stretching behind or hanging down to support climbing plant, usually made from an open framework of intersecting pieces of wood. it does not only involve enhanced plant growth, but also triggers changes in growth form, biomass allocation, morphology and physiology (Gianoli 2001, Park *et. al.*, 2019).

T. occidentalis is an important vegetable, nutritious and medicinal in function and of great demand in west Africa. However, its production still faces a lot of challenges; one of which is moisture stress in the dry seasons. This study is therefore aimed at assessing the effect of mulching and trellising the performance of different landraces of *T. occidentalis* in a humid tropical environment of Nigeria, west Africa.

II. Materials And Methods

Site Area

This study was conducted at the Teaching and Research Farm of the Rivers State university, Port Harcourt Nigeria. it is located on longitude 4.8^{o}N and 7.0^{O}E, on an elevation of 18m above sea level. The study area has average mean annual rainfall of 3,000 to 4500mm in monomodal distribution, lasting from March to November, with August break lasting for the period of 7 days in the month of August. Temperatures are moderate with monthly mean temperatures of the coolest (July and August) and hottest months (February to April) are 2 and 29^{0}C, respectively. Relative humidity in the area remains high throughout the year, with mean values ranging from 78% in February to 89% in July and September (Uko and Tamunobereton-Ari, 2013). The soil of the site is typically sandy loam and formed over sedimentary rocks. It belongs to the ultisol order in the United States Soil Taxonomy (Ojanuga, et. al., 1981).

Experimental Materials

The planting materials includes three local varieties (land races) of *T. occidentalis* namely: Ogoni land race (V1), Ngwa land race (V2), and Iriebe land race (V3). These were procured from a local food market in Port Harcourt, Nigeria.

The mulching material used was dry guinea grass (*Megathyrsus maximus*). The trellis was wood from a bush fallow and twine from a local shop. Bothe the mulching and trellis materials were sourced from the Teaching and Research Farm of the Rivers State University Port Harcourt, Nigeria.

Some of the properties of the topsoil of the experimental site is shown on Table 1

Table 1: Some Properties of the topsoil of the experimental site

Parameters	Value
% Sand	78.6
% Silt	1.4
% Clay	20.0
Textural Class	Sandy Loam
pH (H_2O)	5.90
Organic Carbon	0.80
(%) Organic Matter Content	1.38
Total Nitrogen	0.08
C/N Ratio	10

Treatments and Treatments Application

The 3 factors in the experiment included:

Factor 1: 2 levels of mulch (mulch and no mulch)

Factor 2: 2 levels of trail (trellis and no trellis)

Factor 3: 3 land races of *T. occidentalis* (Ogoni, Ngwa and Iriebe)

This gave a total of 12 treatments (Table 2), which were replicated 3 times.

The land was manually cleared and mapped out into subplots of 2m x 5m each. Planting was done on flats with minimal tillage on the spot for seed planting. The planting was two seed per hole at 3cm depth, with a spacing of 1m x 1m within and between rows. Thinning to 1 plant and supply of ungerminated seeds was done a week after germination. The dry guinea grass was manually cut into small sizes and evenly spread in the relevant subplots at a 5cm thickness layer. The trellis sticks were placed close the vines of the relevant subplots.

The plots were watered to field capacity once a day and kept weed free by manually weeding once a week.

Table 2: Treatment Combinations

Treatment	Description
MT Ogoni	Mulch + Trellis + Ogoni Land Race
MT Ngwa	Mulch + Trellis + Ngwa Land Race
MT Iriebe	Mulch + Trellis + Iriebe Land Race
NMT Ogoni	No Mulch + Trellis + Ogoni Land Race
NMT Ngwa	No Mulch + Trellis + Ngwa Land Race
NMT Iriebe	No Mulch + Trellis + Iriebe Land Race
MNT Ogoni	Mulch + No Trellis + Ogoni Land Race
MNT Ngwa	Mulch + No Trellis + Ngwa Land Race
MNT Iriebe	Mulch + No Trellis + Iriebe Land Race
NMNT Ogoni	No Mulch + No Trellis + Ogoni Land Race
NMNT Ngwa	No Mulch + No Trellis + Ngwa Land Race
NMNT Iriebe	No Mulch + No Trellis + Iriebe Land Race

Data collection

Crop growth and yield parameters were taken weekly from 20% of the stands in each subplot; except for percentage germination which was taken daily throughout the germination period.

The % germination was calculated using the formular below

$$\% \text{ Germination} = \frac{\text{Actual number of germinated seed}}{\text{Expected number of germinated seed}} \times 100$$

The vine length was measured weekly after seedling emergence, using a twine placed from the base of the plant to the tip of the stem and then using a meter rule to estimate the length. The number of leaves were taken biweekly, after seedling emergence. The fresh weight yield of the above ground biomass was taken at 8 weeks after seedling emergence (10WAP). These were oven dried at 70^0C to constant weight and the weight taken for the dry matter weight.

All data collected on various parameters were subjected to analysis of variance according to the procedure outlined by Steel and Torrie (1980) for factorial experiments. Detection of differences between treatment means was carried out using the Fishers' LSD at 5% probability level.

III. Results And Discussions

Effect of Treatments on Seedling Emergence

The mulching effect on seedling emergence is as shown on Fig. 1. The mean values of seedling emergence for mulched plots were 77% and 84% for unmulched plots. Ugege et. al., 2010 similarly reported a non-significant effect of mulching a sandy loam soil on seedling emergence of *Telfaria occidentalis.*

However, Tolasa and Eshetu (2014) reported that mulching did not significantly affect germination and growth parameters of hot pepper (*Capsicum annum*). Mulching is also reported to significantly increase percentage of seedling emergence of cotton and soya bean (Acharya and Hati 2018) increase summer squash (Kumar and Sharma 2018), *Telfaria occidentalis* (Olaniyi and Ajao 2011), cowpea and watermelon (Abderlrahman *et. al.,* 2016). Obalum *et al.,* (2017) reported higher seedling emergence in dry season trial of a tillage, mulching and spacing research on *Telfaria occidentalis.* This suggests that effect of mulching on seedling emergence depends on the crop, soil type and season of the year.

There were significant differences in the seedling emergence of the three different landraces (P<0.05). The Iriebe landrace had the highest seedling emergence (96%) followed by the Ngwa landrace (85%) and the Ogoni landrace (60%). This suggests that with respect to seedling emergence, the Iriebe and Ngwa landraces are better adapted to the sandy loam ultisol of the experimental site (Fig.2).

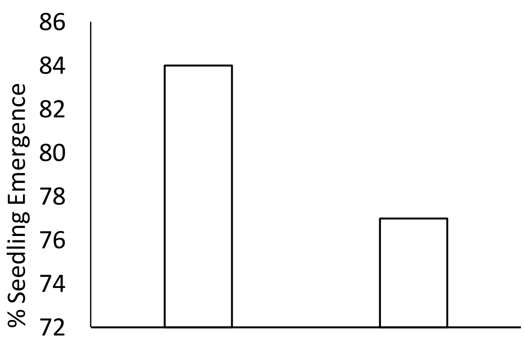

Fig. 1: Effect of mulching on Seedling Emergence

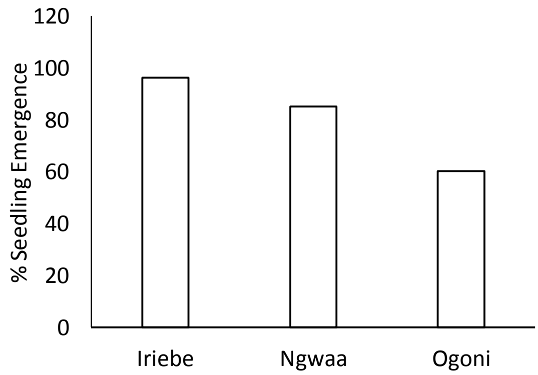

Fig. 2: Effect of Land Race on % Germination

An interaction of mulching and landrace (Fig.3) showed that mulching reduced seedling emergence for all the landraces although this reduction was not significant. This agrees with a similar report by Ugese *et. al.,* 2010) on a sandy loam but differs from findings Obalum *et. al.,* (2017) who reported a significant increase in seedling emergence of *Telfaria occidentalis* as a result of mulching in a dry season cultivation.

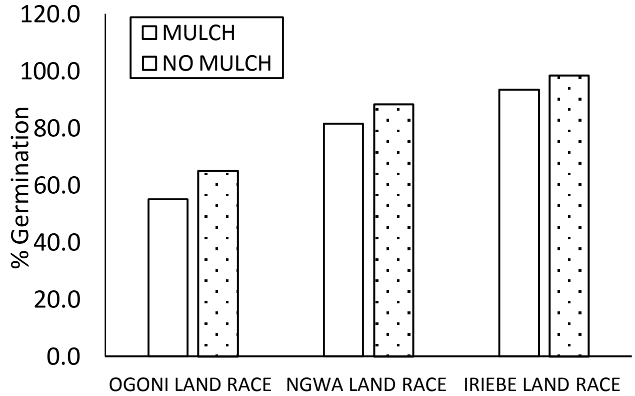

Fig.3: on Seedling Emergenceas affected by Mulch and Land Race

Effect of Treatments on Vine Length of Telfaria occidentalis

The mulching and trellising effects on the vine length of Telaria occidentalis are shown on Figs. 4 and 5. Within the first 6 weeks after planting (WAP), there were no differences in vine length due to mulching nor trellising. However, from 8WAP both mulching and trellising gave higher vine lengths when compared with no mulching and no trellising. The mulching effect was significant while the trellising was not. This also agrees with previous findings (Acharya and Hati (2018), Kumar and Sharma (2018), Olaniyi and Ajao (2011), Abderlrahman *et. al.*, (2016) and Obalum *et al.*, (2017).

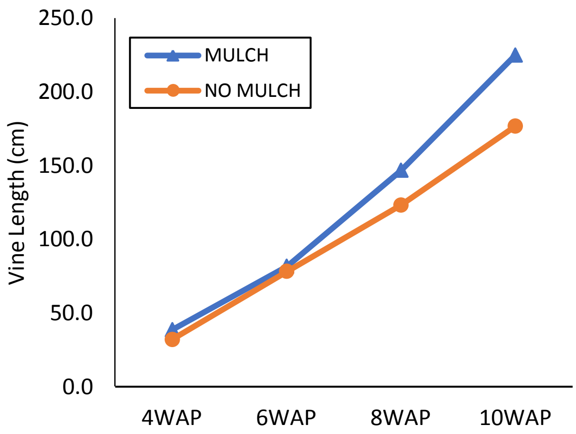

Fig.4: Vine Length as Affected by Mulching

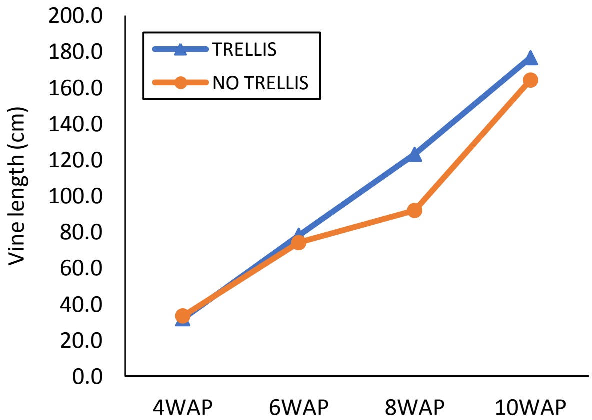

Fig.5: Vine Length as Affected by Trellising

At 10WAP, the effect of landrace on vine length was in the order Ngwa > Ogoni > Iriebe with values 256.4cm > 179.5cm > 129.6cm (Fig. 6). This differed from the order in seedling emergence (Iriebe >Ngwa > Ogoni).

The interaction between mulching, trellising and landrace on vine length of *Telfaria occidentalis* is as shown on Table 3. Mulch + trellis+ Ngwa landrace gave a significantly increased vine length (342.3cm) when compared to other treatments. This was followed by no mulch+no trellis+ Ngwa (221.8cm) and No mulch + trellis + Ngwa (205cm). All the various interactions of mulch, trellis and Ngwa landrace had higher values of vine length than the other landraces. These were followed by Mulch + trellis+ Ogoni landrace.

Generally, mulching, along with trellising gave higher vine length than the no mulch and no trellising, for all landraces.

Table 3. Interaction of mulching, trellising and landrace on the vine length

Treatment	Mean Vine Length (cm)			
	4WAP	6WAP	8WAP	10WAP
MT Ngwa	59.2[a]	112.0[a]	195.8[a]	342.3[a]

NMNT Ngwa	49.3^{ab}	93.5^{ab}	120.2^{bcd}	221.8^{b}
NMT Ngwa	35.5^{abc}	87.5^{ab}	138.3^{abcd}	205.0^{b}
NMT Ogoni	34.5^{bc}	84.7^{ab}	150.8^{ab}	200.8^{b}
MT Ogoni	28.7^{bc}	64.0^{b}	148.0^{abc}	204.2^{b}
MT Iriebe	27.7^{bc}	68.7^{b}	96.2^{bcd}	127.7^{c}
NMNT Iriebe	26.8^{bc}	59.7^{b}	72.7^{d}	137.2^{c}
NMT Iriebe	25.7^{bc}	62.3^{b}	80.0^{cd}	124.0^{c}
NMNT Ogoni	24.2^{c}	69.0^{b}	82.8^{bcd}	133.5^{c}

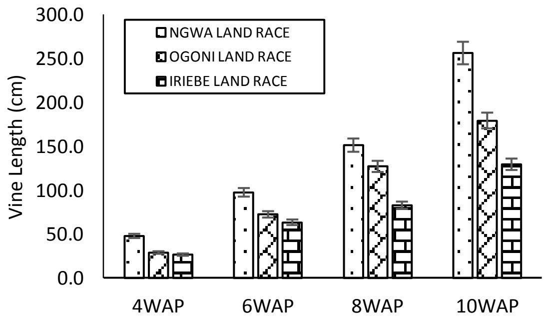

Fig.6: Vine Length as Affected by Land Race

N – No, M – Mulch, T- Trellis

Means on the same column that do not share a letter are significantly different

Effect of Treatments on Number of Leaves of Telfaria occidentalis

Mulching significantly affected number of leaves of *Telfaria occidentalis* (Fig.7), but there was no differences in number of leaves with trellising (Fig. 8). Chukwudi and Agbo (2014) reported significantly higher yield of leaves with trellising in a lowland humid tropical sandy clay loam, in Nsukka South Eastern Nigria.

With respect to number of leaves as affected by landrace, the trend was different as with vine length. This was in the order Ngwa (170.0) > Iriebe (133.7) > Ogoni (103.2) at 10WAP (Fig.9).

The interaction between mulching, trellising and landrace on number of leaves of *Telfaria occidentalis* shows that mulched and trellised Ngwa landrace had number of leaves significantly different from the other treatments (Table 4). This was followed by mulched and trellised Iriebe landrace. Mulching and trellising gave higher number of leaves than when the landraces were not mulched and trellised.

Fig.7: Effect of Mulch on Number of leaves

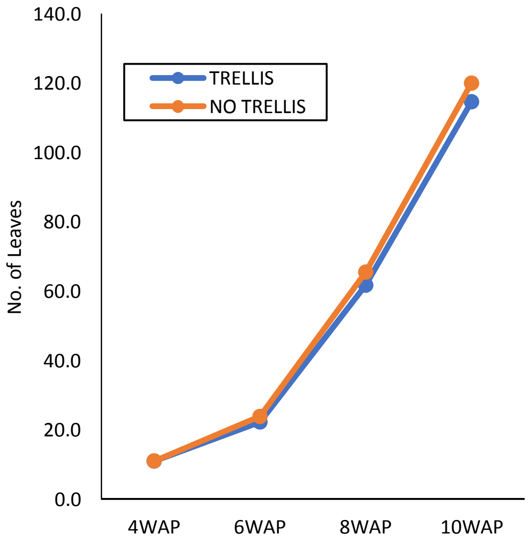

Fig.8: Effect of Trellis on Number of leaves

Table 4. Interaction of mulching, trellising and landrace on number of leaves

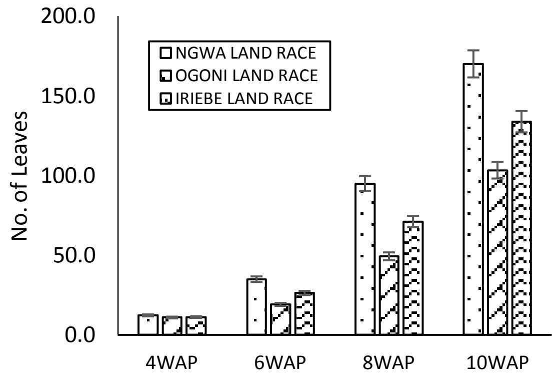

Fig.9: Number of leaves as affected by landrace

Treatment	Mean Number of Leaves 4WAP	6WAP	8WAP	10WAP
MT Ngwa	13.7^{a}	49.0^{a}	146.0^{a}	263.3^{a}
NMNT Ngwa	11.7^{a}	30.3^{b}	81.7^{b}	135.7^{b}
MT Iriebe	11.5^{a}	34.2^{ab}	92.3^{b}	171.3^{b}
NMT Iriebe	11.2^{a}	22.2^{b}	55.2^{b}	108.8^{b}
NMT Ngwa	11.0^{a}	25.2^{b}	56.7^{b}	111.0^{b}
NMNT Ogoni	10.8^{a}	19.0^{b}	49.2^{b}	103.2^{b}
NMT Ogoni	10.7^{a}	19.3^{b}	73.2^{b}	124.0^{b}
NMNT Iriebe	10.5^{a}	22.2^{b}	65.5^{b}	121.0^{b}
MT Ogoni	10.0^{a}	27.5^{b}	77.3^{b}	143.2^{b}

N – No, M – Mulch, T- Trellis

Means on the same column that do not share a letter are significantly different

Effect of Treatments on Weight Yield of Telfaria occidentalis

Mulch significantly affected the fresh weight of *Telfaria occidentalis* with 124.8kgha^{-1} when compared to unmulching on fresh weight of 113.2 kgha^{-1} (Fig.12). there were, however, no differences in the dry matter weight. Kumar and Sharma (2018) reported significant improvement in growth and yield of summer squash with mulching. Tolasa and Eshetu (2014) indicated that using different mulches did not show any significant difference on germination and growth performance of hot pepper. However, Olaniyi and Ajao (2011) reported significant increase in growth parameters *of Telfaria* occidentalis, due to mulching.

Trellising also followed the same trend (Fig. 14) with the trellised plots having a significantly higher fresh leaf yield (128.1 kgha^{-1}), when compared with the untrellised (109.9 kgha^{-1}). Chukwudi and Agbo (2014) also observed improved yield with trellising of *T. occidentalis*. It could be concluded that *T. occidentalis* had a high misture content, being a succulent leaf as indicated by the very low dry matter weight.

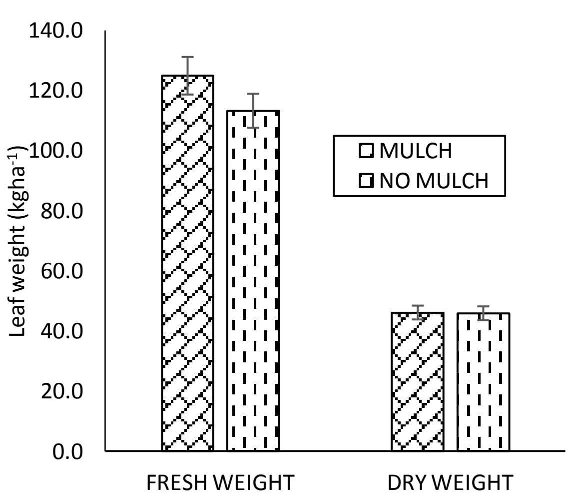

Fig.10: Effect of Mulch on Leat Yield of *T.occidentalis*

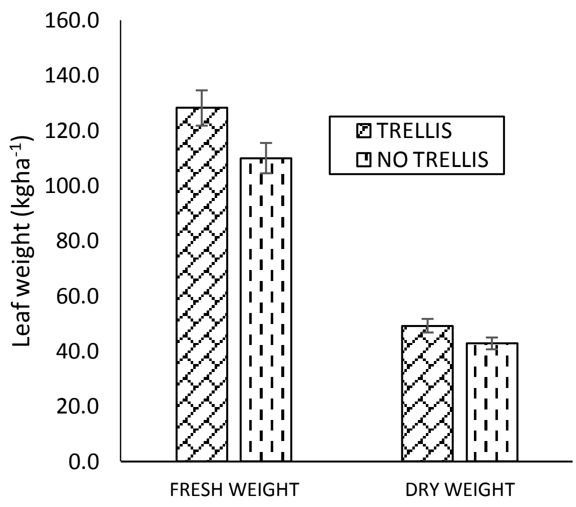

Fig.11: Effect of Trellis on Leat Yield of *T.occidentalis*

The three landraces differed significantly with both fresh and dry matter yields (Fig12). The fresh weight was in the order 136.1 > 116.4 > 104.5 kgha^{-1} for the Ngwa, Iriebe and Ogoni landraces respectively.

Interaction of mulching, trellising and landrace on the leaf yield of *T. occidentalis* showed significant differences among treatments (Table 5). Results showed that mulched trellised Ngwa landrace was significantly higher than all the other treatments. (P<0.05). This was followed by mulched trellised Iriebe landrace.

Table 5: Interaction of Mulching,

Trellising and

Landrace on the Weight

Yield

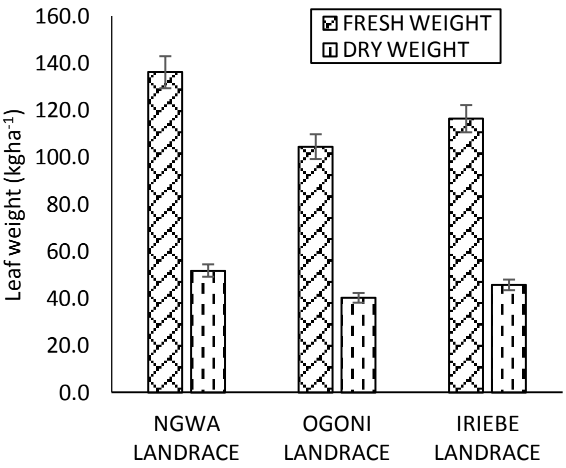

Fig.12: Leaf Yield of *T. occidentalis* as Affected by Landrace

Treatment	Fresh Weight	Dry Matter Weight
MT Ngwa	173.0[a]	62.5[a]
NMNT Ngwa	138.0[ab]	52.0[ab]
MT Iriebe	135.5[ab]	48.5[abc]
NMT Ogoni	123.0[bc]	48.0[abc]
NMT Ngwa	118.5[bc]	46.5[bc]
MT Ogoni	117.0[bc]	45.0[bc]
MNT Ngwa	115.0[bc]	46.5[bc]
NMNT Iriebe	114.5[bc]	49.5[abc]
MNT Iriebe	114.0[bc]	40.5[bc]
NMT Iriebe	101.5[bc]	44.5[bc]
MNT Ogoni	94.5[bc]	33.5[c]
NMMT Ogoni	83.5c	34.5[c]

IV. Conclusion

Mulching, trellising and the three landraces studied affected seedling emergence, vine length, number of leaves and leaf yield of *Telfaria occidentalis* in different ways.

Mulching negatively affected seedling emergence, although not significantly at the level of probability used (P<0.05). However, mulching alone improved vine length, number of leaves and fresh leaf yield across the three land races. Trellising alone, did not significantly affect vine length and number of leaves; but improved fresh leaf yield.

A combination of mulching and trellising better improved vine length in the Ngwa and Ogoni landraces but the Iriebe landrace. Mulching and trellising significantly improved number of leaves in the three landraces. However, mulching and trellising significantly improved fresh leaf weight in only Ngwa and Iriebe landraces.
Results showed that the Ngwa landrace was significantly higher than all the other landraces, in the growth and yield parameters measured. This was followed by Iriebe with respect to number of leaves and fresh leaf weight.

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