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Effects of Different Water Sources on Growth Performance and Nutritional Composition of Hydroponic Maize Varieties

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ABSTRACT

This study evaluated the effects of two water sources on the growth performance and nutritional composition of two hydroponically grown maize varieties. The experiment followed a 2 × 2 × 2 factorial arrangement in a completely randomized design (CRD) consisting of two sources of water (tap water and fishpond water), two varieties of maize seeds (OBA 2000 and local white maize), and two harvesting regimes (8th and 10th days after germination). The grains were cleaned, treated, and sprouted into hydroponic maize fodder using perforated aluminum trays (36 cm × 45 cm) with a 3.5 cm depth for 10 days. All maize grains were manually irrigated using a plastic sprayer every 3 h from 8:00am to 6:00pm each day. The results showed significant effects (P<0.05) of maize seed varieties, water sources, and harvesting regimes on nutritional values, plant height, leaf number, leaf length, leaf width, fodder mat thickness, herbage yield and dry matter yield. OBA 2000 maize fodder exhibited higher (P<0.05) agronomic indices and nutrients than local white maize hydroponic fodder in both tap water and fish water irrigated fodders on days 8 and 10 harvests. Fishpond water-irrigated fodder had higher (P<0.05) agronomic indices and nutrients than tap water-irrigated fodder. Harvesting on day 10 resulted in better (P<0.05) agronomic indices and nutrients than that on day 8. Hence, the OBA 2000 maize seed variety irrigated with fishpond water and harvested on day 10 is recommended for hydroponic maize fodder production in this study.

Keywords:
Fshpond water; harvesting regimes; local white maize; OBA 2000 maize; tap water

1. Introduction

Green fodder is extremely important for livestock productivity and forms the basis of livestock feed resources (Iriso and Maduako, 2025). However, the seasonality of conventional forage production under tropical conditions causes variations in conventional fodder production and quality throughout the year, leading to seasonal variations in livestock productivity. In addition, the rapid increase in urban migration or growth in developing countries has led to a reduction in the size of farmland owned by each household for producing green fodder.

As a viable alternative to high-quality green fodder in resource-constrained environments, hydroponics has the potential to revolutionize animal agriculture and enhance global food security (Sobur et al., 2025). Hydroponic fodder is an alternative solution for providing sustainable quality forage for ruminants.

To address this gap in green fodder production, researchers have identified hydroponic fodder production as a suitable alternative to supplement poor pasture livestock feed sources (Bakshi et al., 2017). The hydroponic system of fodder production is a viable measure to solve the problem of seasonal scarcity of green fodder, especially for urban livestock owners and landless smallholder farmers in the region. Hydroponic fodder is suitable for ruminants (Naik et al., 2014; Limba 2015) and other animal species (Adebiyi et al., 2018; Moin et al., 2023). This technology is best suited for areas affected by chronic water shortages or where irrigation infrastructure is deficient (Bakshi, 2018). This soilless farming technology involves germinating maize grains in a controlled environment, resulting in nutrient-rich green fodder in substantially less time (usually 7-10 days) than field-grown forage (Tadilo and Beyero, 2025).

The word hydroponics originated from the Greek word 'water work.' Hydro means 'water', and ponic means 'working.' Hydroponic fodder production is the science of growing plants under controlled environmental conditions in a water or nutrient broth medium without the use of soil for a short growth period of 7–10 days. This indicates that water plays a critical role in the production of hydroponic fodder. Since the availability of water required for sustainable fodder cultivation is limited due to a decline in groundwater and freshwater resources as a result of the impact of climate change. Thus, there is renewed interest in utilizing other available sources of water, especially in circularized farming systems under conditions of water scarcity. This would help reduce the dependency on water obtained from rainfall or fresh water alone for hydroponic production (Fazaeli et al., 2017).

Despite its advantages, the adoption of hydroponic maize fodder production faces hurdles, including high initial investment costs for controlled-environment infrastructure and potential scalability issues for large-scale operations (Sobur et al., 2025). Other factors, such as grain quality and harvesting duration, determine the quality of the fodder produced using hydroponic systems. Many different types of grains can be used in hydroponic system production, such as barley, wheat, oats, and maize; however, maize is the most widely used grain. Maize is a grain crop that is commonly cultivated worldwide. Maize is used for both feed and food purposes. However, the variety of maize available and the environment differ between countries, requiring the evaluation of hydroponic fodder production from different varieties under the prevailing natural environmental conditions. Further studies are required to determine the optimal combinations of maize varieties, harvesting regimes and water sources. Therefore, this study aimed to assess the influence of maize grain varieties, harvesting regimes, and water sources on the growth and nutritional indices of hydroponically grown maize fodder.

2. Materials and Methods

2.1 *Location of the research*

The research was conducted at the University of Port Harcourt, Port Harcourt, Nigeria, during the late dry season of the year.

2.2 ***Selection of maize variety for hydroponics fodder production***

Two varieties of maize seeds were obtained from two sources: hybrid maize seeds (OBA 2000) from the Department of Crop and Soil Science, University of Port Harcourt, Nigeria and Local white maize seeds from a local seed vendor. Both grains were cleaned, treated, and sprouted into hydroponic maize fodder using perforated aluminum trays measuring 36 cm × 45 cm with a depth of 3.5 cm. Two different irrigation treatments (tap water and fishpond water) were used for each maize variety. All maize grains were manually irrigated using a plastic sprayer every 3 h from 8am to 6pm.

2.3 ***Data collection***

Three replicates of the fodder were assessed for agronomic indices and yield on the 8th and 10th days. A 0.25 × 0.25 cm quadrat was used to harvest the sprouts on the 8th and 10th day. Thereafter, agronomic parameters such as fodder mat thickness, leaf length, plant height, number of leaves, and leaf width were determined.

2.4 ***Chemical Analysis***

Milled samples of the hydroponic fodder were assessed for dry matter, crude protein, fiber fractions, ether extract, and ash content according to the AOAC (2005) procedure.

2.5 Data analysis

The experiment was a 2 × 2 × 2 factorial scheme (two varieties of maize seeds, that is, OBA 2000 hybrid and Local), two sources of water (tap water and fishpond water), and two (2) different harvesting durations (8th and 10th days) in a completely randomized design (CRD). All data were subjected to analysis of variance (ANOVA). Means were separated using Duncan's Multiple Range Test (SAS, 2002).

3. Results and Discussion

3.1 Growth indices of hydroponic maize fodder

Table 1 shows the influence of seed variety, water source, and harvesting duration on hydroponic maize fodder.

Seed variety, water source, and harvesting duration significantly ($P < 0.05$) influenced all agronomic parameters. The OBA 2000 seed variety had a significantly ($P < 0.05$) higher influence on plant height (12.70 cm), leaf number (1.39), leaf length (8.87 cm), and leaf width (1.26 cm) than the local white maize seed variety did. Fishpond water produced higher ($P<0.05$) plant height (11.64 cm), leaf number (1.26), leaf length (8.29 cm), and leaf width (1.08 cm) than the values obtained from tap water irrigation. The harvesting duration values were higher on the 10th day for plant height (15.11 cm), leaf number (1.30), leaf length (10.65 cm), leaf width (1.70 cm), and fodder mat thickness (1.20 cm). The higher plant height, number of leaves, leaf length, leaf width, fodder mat thickness, herbage yield, and dry matter yield of the OBA 2000 seed variety over the local white maize seeds revealed the superiority of the OBA 2000 seed variety as a hybrid variety developed by reputable seed producers. Similar findings were reported by Odedire et al. (2019). The higher growth parameters in fodder irrigated with fishpond water might be due to its high nutrient concentration as a result of organic matter decomposition and mineral solubilization in the ponds. The 10th day harvesting regime had better values than the 8th day harvesting regime, as corroborated by previous research. Several authors have reported on factors that could affect biomass production, such as management, amount, and frequency of irrigation, usage of nutrient solution, climate (temperature and humidity), density, type and quality of the grain, load of seeds on each tray, and growth period (Gebremedhin, 2015; Getachew et al.,2020).

Table 1. Influence of seed varieties, water sources and harvesting regimes on growth indices of hydroponic maize fodder

Parameters	PLH (cm)	NL	LLL (cm)	LLW (cm)	FMT (cm)
Seed Varieties					
OBA 2000	12.70^{a}	1.39^{a}	8.87^{a}	1.26^{a}	1.00^{b}
Local white maize	10.02^{b}	1.11^{b}	6.47^{b}	0.95^{b}	1.11^{a}
SEM	0.12	0.7	0.12	0.05	0.12
P value	0.00	0.00	0.00	0.00	0.00
LOS	**	**	**	**	**
Water Source					
Tap water	10.54^{b}	1.18^{b}	6.57^{b}	1.06^{b}	2.01^{a}
Fishpond Water	11.64^{a}	1.26^{a}	8.29^{a}	1.08^{a}	1.09^{b}
SEM	0.11	0.07	0.12	0.04	0.6
P value	0.00	0.39	0.00	0.74	0.00
LOS	**	**	**	**	**
Harvesting Regime					
8th day	8.42^{b}	1.16^{b}	5.28^{b}	0.66^{b}	0.82^{b}
10th day	15.11^{a}	1.30^{a}	10.65^{a}	1.70^{a}	1.20^{a}
SEM	0.12	0.07	0.12	0.04	0.09
P value	0.00	0.99	0.00	0.00	0.00
LOS	**	**	**	**	**

^{abc} Means in the same column with different superscripts differ significantly (P<0.05); LOS: Level of significance; SEM, standard error of mean; NS, non-significant (P>0.05); PLH: Plant height; NL, number of leaves; LLL, leaf length; LLW: Leaf width; FMT: Fodder mat thickness.

3.2 Herbage and dry matter yields of hydroponic maize fodder

Table 2 shows the effects of seed variety, water source, and harvesting duration on the herbage and dry matter yields of hydroponic maize fodder. Although no significant differences (P>0.05) were recorded, the OBA 2000 seed variety, fishpond water, and harvesting duration on the 10th day had higher herbage and dry matter yields than the local white maize variety, tap water irrigated hydroponics fodder, and on day 8th of fodder harvest.

Table 2. Influence of seed varieties, water sources and harvesting duration on herbage yield and dry matter yield of hydroponics maize fodder

Indices	Parameters	
Seed Variety	Herbage Yield	Dry matter yield
OBA 2000	533.10	214.49
Local white maize	480.13	172.53

Indices	**Parameters**	
SEM	1.88	2.55
P value	397.36	135.26
LOS	NS	NS
Water Source		
Tap water	497.78	190.70
Fishpond water	515.45	196.31
SEM	1.88	2.55
P value	44.30	2.42
LOS	NS	NS
Harvesting Regime		
8th day	474.38	166.88
10th day	538.55	220.14
SEM	1.88	2.55
P value	0.00	0.00
LOS	NS	NS

^{a,b} =Means on the same column with different superscripts differ significantly (P<0.05); LOS=Level of significance; SEM=standard error of mean; NS= Not significant (P>0.05)

3.3 Proximate composition of hydroponic maize fodder

Table 3 shows the influence of maize seed varieties, water sources, and harvesting regimes on the proximate composition of hydroponically grown maize fodder. The OBA 2000 seed variety had higher (P<0.05) crude protein (11.91%), ether extract (3.04%), crude fiber (9.92%), and ash (3.69%) contents, but lower nitrogen-free extract (61.81%) and dry matter (88.88%) contents than the local white maize variety hydroponic fodder. The harvesting regime on day 10 resulted in higher (P<0.05) crude protein (13.55%), ether extract (3.43%), crude fiber (11.42%), and ash (3.73%) contents, but lower nitrogen-free extract (61.22%) and dry matter (86.83%) than those on day 8. Fishpond water had higher (P<0.05) crude protein (10.54), ether extract (3.23), crude fiber (10.61%), ash (3.68%), and dry matter (88.46%), but lower nitrogen-free extract (61.39%) than tap water-irrigated hydroponic fodders. The reason for the difference (DM) difference among seed varieties in this study might be due to the difference in growth rate, which is proportional to the rate of conversion of starch stored in the seed into a simple sugar to give off carbon dioxide and water and produce energy *(*Bakshi et al., 2017). The crude protein (CP) content recorded for seed varieties (OBA 2000 and local white maize seed varieties), harvesting regimes (8th and 10th day), and water sources (fishpond water and tap water) were comparable to values reported by other authors (Singh 2011; Naik et al., 2013; Naik et al., 2014; Getachew et al., 2020), but lower than values reported by other authors (Thadchanamoorthy et al., 2012; Gebremedhin, 2015).

The variation in the findings might be attributed to the differences in the seed variety, harvesting time of the study, and sources of water used for irrigating the maize hydroponics fodder. However, the values were higher than the minimum 6-8% required to facilitate feed utilization, as reported by other researchers (McDonald et al., 1995; Mathis et al., 2000; NRC, 2001). Hence, the hydroponic maize fodders of these two seed varieties (OBA 2000 and local white maize seed varieties), harvesting regimes (8th and 10th days), and water sources (tap water and fish pond water) are capable of providing adequate nitrogen required by rumen microorganisms for microbial synthesis of protein that could be transformed into meat or milk. The ether extract (EE) obtained in this study is comparable to the values reported by other scholars (Singh 2011; Naik et al., 2013; Alalade et al., 2019), but lower than the values reported by several authors (Thadchanamoorthy et al., 2012, Naik et al., 2014).

Table 3. Influence of seed varieties, water sources and harvesting duration on the proximate composition (%DM Basis) of hydroponic maize fodder

Parameters	CP%	EE%	CFIBRE %	ASH%	M%	NFE%	DM%
Seed Varieties							
OBA 2000	11.91^a	3.04^a	9.92^a	3.69^a	11.93^a	61.81^b	88.88^b
Local white maize	10.31^b	2.86^b	8.83^b	3.20^b	10.92^b	62.25^a	89.07^a
SEM	0.03	0.01	0.01	0.01	0.53	0.05	0.06
P value	0.00	0.00	0.00	0.00	0.19	0.00	0.41
LOS	**	**	**	**	**	**	**
Harvesting Regime							
8th day	12.23^b	3.13^b	9.76^b	3.62^b	11.34^b	62.52^a	88.65^b
10th day	13.55^a	3.43^a	11.42^a	3.73^a	11.35^a	61.22^b	86.83^a
SEM	0.04	0.01	0.01	0.01	0.75	0.07	0.09
P value	0.00	0.00	0.00	0.00	0.45	0.00	0.00
LOS	**	**	**	**	**	**	**
Water Sources							
Tap water	10.21^b	2.83^b	9.94^b	3.44^b	11.12^a	62.45^a	88.02^b
Fishpond water	10.54^a	3.23^a	10.61^a	3.68^a	10.71^b	61.39^b	88.46^a
SEM	0.12	0.00	0.01	0.01	0.72	0.05	0.05
P value	0.00	0.00	0.00	0.00	0.33	0.00	0.00
LOS	**	**	**	**	**	**	**

^{a,b} Means on the same column with different superscripts differ significantly ($P<0.05$). SEM= Standard error of mean; LOS= Level of significance; **=significant; NS=not significant; DM=dry matter; CP=crude protein; EE= ether extract; CF=crude fiber; NFE= nitrogen-free extract.

The observed EE content of hydroponic fodder in this study may be due to the improvement in the structural lipids and production of chlorophyll associated with the cultivated plants. The (CF) values in this study are comparable to those reported by several authors (Thadchanamoorthy et al., 2012; Naik et al., 2013; Gebremedhin, 2015; Whay et al., 2022), but lower than those reported by Singh (2011) and Adebiyi et al. (2018). The CF values differed owing to variations in the fiber fractions of the feed or fodder. NFE is an expression of the carbohydrate content of feedstuff or ingredients that are soluble, easily digestible, and available to the animal. This implies that NFE can support VFA production of volatile fatty acids in the rumen during microbial fermentation. The ash content increased due to mineral absorption by the roots throughout the sprouting phase. Sneath and McIntosh (2003) reported that root growth in hydroponic fodders helps mineral uptake, which might change the ash content swiftly from day four onwards. Hence, the process of chelating sprouting makes minerals more available (Shipard, 2005).

3.4 Anti-nutritional factors of hydroponic maize fodder

Table 4 shows a significant effect of seed variety on the tannin, oxalate, and saponin contents of the hydroponic maize fodders. OBA 2000 seed variety had higher ($P<0.05$) phytate (0.19%) and saponin (0.20%) contents and lower tannin (0.01%) and oxalate (0.05%) contents than the local white maize variety hydroponic fodder. The fodder harvested on day 10 had higher phytate (0.13%), saponin (0.19%), and tannin (0.01%) contents and lower oxalate (0.04%) content than that harvested on day 8 did. Fishpond-water-irrigated hydroponic fodder had higher phytate (0.07%), saponin (0.24%), and oxalate (0.05%) contents than tap-water-irrigated hydroponic fodder. The antinutrient values obtained in this study are similar to those obtained by other researchers and below the threshold in fodders that can inhibit enzymatic activities in the body and nutrient absorption in animals when consumed. Shipard (2005) reported that germination and sprouting neutralize inhibitors and enhance the levels of beneficial plant digestive enzymes.

Table 4. Influence of maize seed varieties, water sources, and harvesting duration on anti-nutritional factors of hydroponic maize fodder.

Parameters	%Phytate	%Oxalate	%Saponin	%Tannin
Seed Varieties				
OBA 2000	0.19^{a}	0.05^{b}	0.20^{a}	0.01^{b}
Local white maize	0.07^{b}	0.05^{a}	0.19^{b}	0.01^{a}
SEM	0.06	0.001	0,005	0.00
P value	0.34	0.00	0.00	0.00
LOS	**	**	**	**
Harvesting regime				
Day 8	0.07^{b}	0.05^{a}	0.19^{b}	0.01^{b}
Day 10	0.13^{a}	0.04^{b}	0.24^{a}	0.01^{a}
SEM	0.04	0.00	0.00	0.00
P value	0.36	0.00	0.00	0.00
LOS	**	**	**	**
Water Sources				
Tap water	0.06^{b}	0.04^{b}	0.18^{b}	0.00
Fishpond water	0.07^{a}	0.05^{a}	0.19^{a}	0.00
SEM	0.05	0.02	0.00	0.00
P value	0.03	0.01	0.04	0.00
LOS	**	**	**	**

[a,b] Means on the same column with different superscripts differ significantly($P<0.05$). SEM=Standard error of mean; LOS= Level of significance; **=significant; NS=not significant

3.5 Mineral contents of hydroponic maize fodder

Table 5 shows the effects of maize seed varieties, water sources, and harvesting regimes on the mineral content of hydroponically grown maize fodder. OBA 2000 seed variety had higher ($P<0.05$) sodium (0.17%), potassium (0.44%), calcium (0.15%), phosphorus (0.27%), zinc (42.27 mg/kg), copper (10.01 mg/kg), manganese (12.75 mg/kg), iron (87.40 mg/kg), and lower magnesium (0.16%) content than the local white maize variety hydroponic fodder. The harvesting regime on day 10 resulted in higher ($P<0.05$) sodium (0.20%), potassium (0.52%), calcium (0.17%), phosphorus (0.27%), zinc (39.64 mg/kg), copper (9.40 mg/kg), manganese (11.65 mg/kg), iron (85.99 mg/kg), and magnesium (0.19%) contents than that on day 8 harvest. Fishpond water had higher (P<0.05) sodium (0.15%), potassium (0.43%), phosphorus (0.23%), zinc (35.50 mg/kg), copper (8.25 mg/kg), manganese (11.55 mg/kg), iron (81.64 mg/kg), and magnesium (0.16%) content and lower calcium (0.14%) content than tap water irrigated hydroponics fodder.

Table 5. Influence of maize seed varieties, water sources, and harvesting duration on mineral content of hydroponics maize fodder.

Parameters	%Na	%K	%Ca	%P	%Mg	Zn (mg/kg)	Cu (mg/kg)	Mn (mg/kg)	Fe (mg/kg)
Seed Varieties									
OBA 2000	0.17[a]	0.44[a]	0.15[b]	0.27[a]	0.16[b]	42.27[a]	10.01[a]	12.75[a]	87.40[a]
Local white maize	0.15[b]	0.43[b]	0.19[a]	0.24[b]	0.21[a]	39.65[b]	9.65[b]	11.20[b]	87.23[b]
SEM	0.00	0.00	0.00	0.00	0.00	0.12	0.05	0.48	0.01
P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LOS	**	**	**	**	**	**	**	**	**
Harvesting Regime									
Day 8	0.18[b]	0.34[b]	0.12[b]	0.22[b]	0.15[b]	36.39[b]	8.53[b]	11.43[b]	81.22[b]
Day10	0.20[a]	0.52[a]	0.17[b]	0.27[a]	0.19[a]	39.64[a]	9.40[a]	11.65[a]	85.99[a]
SEM	0.01	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.53
P value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LOS	**	**	**	**	**	**	**	**	**
Water sources									
Fishpond water	0.15[a]	0.43[a]	0.14[a]	0.23[b]	0.16[a]	35.50[a]	8.25[a]	11.55[a]	81.64[a]
Tap water	0.14[b]	0.42[b]	0.14[b]	0.22[a]	0.15[b]	34.63[b]	7.96[b]	10.65[b]	78.30[b]
SEM	0.00	0.02	0.00	0.00	0.00	0.09	0.01	0.01	0.00
P value	0.66	0.00	0.04	0.00	0.00	0.03	0.51	0.00	0.00
LOS	**	**	**	**	**	**	**	**	**

[a,b] Means in the same column with different superscripts differ significantly (P<0.05). SEM= Standard error of mean; LOS= Level of significance; **=significant; NS=not significant

The type of irrigated water used for hydroponic fodder affects the mineral content of the fodder. Hence, the different sources of water used for irrigating the fodders might have influenced the amount of available minerals in the fodders. The mineral contents of the hydroponic maize fodder obtained in the study were similar to the results reported by other scholars (Widiastuti et al.,2022) and were within the dietary requirements for animals, as recommended by NRC (2001) for Ca, Mg, Fe, Mn, Zn, Cu, K, P, and Na.

3.6 Fibre fractions of hydroponic maize fodder

Table 6 shows the effects of seed variety, water source, and harvesting duration on the fiber fractions of hydroponic maize fodder. OBA 2000 seed variety had higher (P<0.05) acid detergent fiber (16.43%), acid detergent lignin (4.05%), and hemicellulose (15.85%) contents and lower neutral detergent fiber (31.87%) and cellulose (12.07%) contents than the local white maize variety hydroponic fodder. The harvesting regime on day 10 resulted in higher (P<0.05) acid detergent fiber (16.60%), hemicellulose (16.19%), neutral detergent fiber (33.79%), and cellulose (14.54%) contents and lower acid detergent lignin (6.08%) content than that on day 8. The fish pond water had higher (P<0.05) acid detergent fiber (16.72%), neutral detergent fiber (33.69%), and hemicellulose (16.97%) contents and lower acid detergent lignin (4.53%) and cellulose (12.07%) contents than the tap water irrigated hydroponics fodder. The NDF values in this study were classified as high quality because they were below the 45% classification index reported by Singh and Oosting (1992). Ball et al. (2007) classified forages with ADF values greater than 43.00 – 45.00% as low-quality forages. This implies that the hydroponic fodder in this study was classified as high quality because the ADF values were below 45%. ADF is similar to NDF but lacks hemicellulose and contains cellulose, lignin, and cutin. Shroeder (2004) reported that as the ADF content increases, forage digestibility decreases. In this study, the fiber contents (NDF, ADF, ADL, hemicellulose, and cellulose) of hydroponically grown maize varieties increased with the harvesting date. The ash content values observed in this study were similar to those reported by Naik et al. (2013). Naik et al. (2013) reported that variations in the fiber fraction content might be attributed to an increase in the number and size of cell walls for the synthesis of structural carbohydrates (cellulose and hemicellulose).

Table 6. Influence of seed varieties, water sources, and harvesting duration on fiber fractions of hydroponics maize fodder.

Parameters	%NDF	%ADF	%ADL	%HEM	%CEL
Seed Varieties					
OBA 2000	31.87^{b}	16.43^{a}	4.05^{a}	15.85^{a}	12.07^{b}
Local white maize	31.96^{a}	15.61^{b}	3.24^{b}	15.52^{b}	12.39^{a}
SEM	0.01	0. 24	0.49	0.24	0.54
P value	0.00	0.01	0.01	0.00	0.20
LOS	**	**	**	**	NS
Harvesting Regime					
Day 8	32.18^{b}	16.08^{b}	6.69^{a}	16.11^{b}	9.38^{b}
Day 10	33.79^{a}	16.60^{a}	6.08^{b}	16.19^{a}	14.54^{a}
SEM	0.05	0.04	0.00	0.01	0.09
P value	0.00	0.00	0.00	0.00	0.20
LOS	**	**	**	**	NS
Water Sources					
Tap water	32.44^{b}	16.59^{b}	5.75^{a}	16.26^{b}	12.41^{a}
Fishpond water	33.69^{a}	16.72^{a}	4.53^{b}	16.97^{a}	12.07^{b}
SEM	0.01	0.42	0.85	0.41	0.94
P value	0.00	0.63	0.40	0.53	0.71
LOS	**	**	**	**	**

^{a,b} Means in the same column with different superscripts differ significantly (P<0.05). SEM=Standard error of the mean; LOS=Level of significance; **=significant; NS=not significant; NDF=neutral detergent fiber; ADF=acid detergent fiber; ADL=acid detergent lignin; HEM=hemicellulose; CEL= cellulose.

4. Conclusion

The nutrient indices of OBA 2000 hydroponic fodder were higher than those of conventional local white maize fodder. The agronomic profiles and nutrient content of fish pond water-irrigated fodder were higher than those of tap water-irrigated fodders.

Harvesting on day 10 resulted in a better agronomic profile and nutrient content than on day 8. Hence, cultivating the OBA 2000 maize seed variety irrigated with fishpond water and harvested on day 10 is recommended for maize hydroponic fodder production in this region. The study further revealed that hydroponic fodder can be utilized as feed for livestock, especially during periods of green fodder scarcity.

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