INTERNATIONAL JOUNAL OF: SCIENCE RESEARCH AND TECHNOLOGY

TIMBOU-AFRICA ACADEMIC PUBLICATIONS
INTERNATIONAL JOURNAL, NOVEMBER, 2022 EDITIONS
VOL. 11 NO. 9 ISSN: 2623-7861

COMPARATIVE STUDY OF EFFECTS OF AGE AT HARVEST ON THE NUTRITIONAL COMPOSITION *Celosia argenta* and *Amaranthus cruentus*

***LAWAL I.A; *AZEEZ G.O; *IMRAN M.O; & **BOLANLE E.O**

*Science Laboratory Technology Department, the Oke-Ogun Polytechnic, Saki, Oyos State, Nigeria. **Science Laboratory Technology Department, Adeseun Ogundoyin Polytechnic, Eruwa.

ABSTRACT

Leafy vegetables are regular ingredient in the diet of the average Nigerians. Maturity at harvest can significantly impact product composition and the nutritive value of the crop. The physiology of growth, development, maturation, ripening and senescence results in pronounced chemical as well as physical changes in the edible plant part.The research that investigated the effects of age at harvest on the proximate, mineral, vitamin and

INTRODUCTION

Vegetables are the fresh and edible portions of herbaceous plants, which can be eaten raw or cooked (Onwordi *et al*., 2009), they contain valuable food ingredients which can successfully utilized to build up and repair the body. Vegetable are variable in maintaining alkaline reserve of the body. They are valued mainly for this high carbohydrate, vitamins and minerals contents. Vegetable may be edible roots, stems, leaves, fruits or seed. Each group contribute to diet in its own way. *Amarathus hybridus*, *celosia argenta*, *corchorus* and *Abelmuschus* esculent are popular edible vegetable in Nigeria (Oyedele *et al.* ,2006).

Vegetables contain both essential and toxic elements over a wide range of concentration. The concentration of these elements is a function of the concentration in the soil in which the vegetables is planted. Leafy vegetables are regular ingredient in the diet of the average Nigeria with their level of consumption, they can provide appreciable amount of nutrient minerals (Onwordi *et al*., 2010). Vegetables are the cheapest and most readily available sources of important proteins, vitamins, minerals and essential amino acids. Vegetable also act

phytochemical compositions of Celosus argenta and Amaranthus cruentus was conducted at the Oke Ogun Polytechnic Saki. A garden was made for the planting of the selected leafy vegetables. The samples were harvested at three harvesting ages; 5, 7 and 9 Weeks After Sowing (WAS). Laboratory analysis was done on the air dried edible portions. The results shown that age at harvest significantly affected the proximate (CHO (60.80 – 43.41)), minerals (K (300 -238.15mg/g)), antioxidant (flavanoid (0.96 – 0.25mg/g) and vitamins (1.46-0.83mg/g) concentrations while the effect was not significant on that of antinutrients (phytate (2.07-0.34)). It was therefore concluded that the optimum time of harvesting Amaranth is between 6 to 8 weeks after sowing, while that of celosia is anytime from the 7th WAS.

Keywords: Maturation, Phytochemical, Proximate, Composition, Antioxidant

as buffering agents for acidic substances produced during the digestion process (Onwordi *et al.,2010).*

Leafy vegetables obtained reach their quality attribute at various stages of growth and development of leaves. Maturity at harvest is critical especially for product of good quality (Kader, 2002).

Leafy vegetables such as lettuce, escarole, spinach, rocket, watercress and other leafy greens are generally characterized as very perishable commodities, with high respiration and water loss rates. Cabbages are a notable exception as they may be stored for long periods. Leafy vegetables obtained from leaves reach their best quality attributes at various stages of growth and development of the leaves. Consequently, there is a wide range of possibilities for harvesting, depending on the final destination of the product, the desired quality attributes, and their resistance or tolerance to withstand handling and processing (Hughes, 2009). To meet the demand for nutritionally balanced food for the world's increasing population and relieve the intense pressure on land use and natural resources, plant species used as food must be diversified (Hughes, 2009). Wild leafy vegetables are harvested by rural community from crop fields at different stages of plant growth (Modi *et al*., 2006). It is likely that for some wild leafy vegetables there is a preferred stage of plant development when flavour and palatability are favourable for human consumption (Albert, 2007).

Celosia is most commonly seen in West Africa, from Sierra Leone to Nigeria. *Celosia argentea* is also present in Ethiopia, Somalia, and Kenya, other parts of East Africa, Mexico and Central Africa. C. *argentea* is an important cultivated vegetable in the rainforest zone

of Nigeria, Benin, Cameroon, Gabon, and Togo. The well known species of *celosia* are *Celosia argentea, Celosia Cristata, Celosia spicata and Celosia isertii* (Adegbaju *et al.*, 2019).
Amaranthus species are a highly popular group of vegetables that belong to different species. *A. cruentus* and *A. hypochondriacus* are the grain type, while the rest are the vegetable type. Both leaves and seeds contain protein of an unusually high quality. The grain is milled for flour or popped like popcorn. The leaves of both the grain and vegetable types may be eaten raw or cooked. Amaranths grown principally for vegetable use have better tasting leaves then the grain types. Amaranth consists of 60-70 species, 40 of which are considered native to the Americas. Over 400 varieties within these species are found throughout the world in both temperate and tropical climates, and fall into one of four categories: grain, vegetable, ornamental or weed. In Nigeria especially Yoruba community all species are referred to as "tete" even though they may add a second name to indicate a particular variety or species. The Hausas refers to them as "alaiyaho while Igbos call them "imne". *Amaranthus* is highly nutritious, both the grain amaranth and leaves are utilized for human as well as for animal food. Boiling and squeeze washing lead to more loss than blanching especially vitamin c content (Babalola *et al*., 2010).
Vegetable amaranth has received significantly less research attention than grain amaranth. However, it has been rated considerably higher in minerals, such as calcium, iron, phosphorous and carotenoids (Alegbejo, 2013). When nutrients are translocated from the topmost parts of vegetables to the other portion and harvest is done with the method of detopping, the consumers will be consuming it without knowing that the required nutrients have been translocated to the other parts not harvested. Since detopping is the common method generally adopted in Nigeria, it is important to determine the best age at harvest to get the highest yield and optimum nutrient around the topmost part of leafy vegetables (Alegbejo, 2013). The main aim of this study was to determine and compare the best age of harvesting ***Amaranthus cruenthus*** and ***Celosia argentea*** to obtain highest yield of nutrients.

MATERIALS AND METHODS

Study site

The experimental garden was established on a plot of fertile soil at the back of the department of Science Laboratory Technology of the Oke Ogun Polytechnic, Saki .The experiment was carried out during the raining season of 2021(for 63 days from July 4^{th} 2021 to September 4^{th} 2021).

TIJSRAT
ISSN: 2623-7861

Celosia argenta *Amaranthus cruentus*

Figure 3: Image of the vegetables grown

Full image of the garden

Map of the study area

Fig 1: map of Saki West Local Government

The experiment was conducted during the major raining season, no watering was done.

TIJSRAT
ISSN: 2623-7861

Plant material, sowing and harvest

The samples seeds were obtained from the seed seller at Gbawojo market in Saki. All the samples seed were sprinkled onto the prepared plot, then, the soil was disturbed with hand to cover the seed and harvesting was done first at 5th week after sowing (5 WAS), followed by 7th week after sowing (7 WAS) and lastly 9th week after sowing (9 WAS).

Laboratory work

The fresh leaves were washed with well water to remove the unwanted matter and air dried until properly dried with continuous turning to avert fungal growth. The samples were crunched and sieved through a 2mm sieve size to obtain fine form of it followed by laboratory analysis.

Proximate analysis

This includes, Moisture content, Ash content, Crude fibre content, Crude protein content and Carbohydrate content. They are all examined using standard analytical method.

Mineral Content Analysis

Mineral concentration, antioxidant and antinutrient analysis were also carried out using a standard mineral content method of analysis.

Digestion

About 0.5g of the sample was weighed into 100ml beaker, nitric acid and perchloric acid was mixed in the ratio 1:2. The mixture in the sample was placed on a hot plate to undergo digestion at 150^{o}c for 30 minutes; this depends on the nature of the vegetable sample until it changed to a colourless solution or a milky solution. The beaker was covered with already washed glass and allowed to cool, after which distilled water was added to make 25ml. the same thing was done for other samples.

Data Analysis

All the data collected were subjected to analysis of variance (ANOVA) using Microsoft Excel (version 2007) and IBM-SPSS (VERSION 21.0). Treatment mean were separated using the least significant difference where significant difference occurred at 5% level of probability.

RESULTS AND DISCUSSION

Results

Table 11: Fresh leaves moisture content (%) Mean value ± SD of triplicate result

Vegetables	5 W.A.S	7 W.A.S	9 W.A.S
Amaranth	$88.98^{a}\pm1.98$	$86.60^{b}\pm1.60$	$86.90^{a}\pm1.90$
Celosia	$90.66^{a}\pm1.66$	$92.00^{a}\pm1.00$	$81.75^{b}\pm1.75$

SD= Standard Deviation

Means with the same superscript are not significantly different

Table 12: Proximate composition (%) of the samples at harvest age of 5,7 and 9 was(weeks after sowing). Mean value ± SD of triplicate result

Sample Age	Protein	Fat	C fibre	Ash	Moisture	CHO
Amaranth 5WAS	$24.46^{e}\pm1.00$	$0.54^{c}\pm0.01$	$3.50^{a}\pm1.00$	$1.15^{a}\pm1.00$	$9.83^{d}\pm1.00$	$60.52^{c}\pm1.00$
Amaranth 7WAS	$26.32^{d}\pm1.00$	$0.81^{ab}\pm0.01$	$2.77^{a}\pm1.00$	$1.71^{a}\pm1.00$	$11.67^{bcd}\pm1.00$	$46.73^{e}\pm1.00$
Amaranth 9WAS	$23.10^{ef}\pm1.00$	$0.51^{c}\pm0.01$	$2.50^{a}\pm1.00$	$1.09^{a}\pm1.00$	$12.00^{bc}\pm1.00$	$60.80^{c}\pm1.00$
Celosia 5WAS	$24.09^{ef}\pm1.00$	$0.63^{bc}\pm0.01$	$3.00^{a}\pm1.00$	$1.34^{a}\pm1.00$	$11.33^{bcd}\pm1.00$	$55.23^{d}\pm1.00$
Celosia 7WAS	$38.24^{a}\pm1.00$	$0.85^{a}\pm0.01$	$2.70^{a}\pm1.00$	$1.80^{a}\pm1.00$	$13.00^{ab}\pm1.00$	$43.41^{ef}\pm1.00$
Celosia 9WAS	$24.09^{ef}\pm1.00$	$0.54^{c}\pm0.01$	$2.07^{a}\pm1.00$	$1.13^{a}\pm1.00$	$12.30^{bc}\pm1.00$	$59.67^{c}\pm1.00$

SD= Standard Deviation

Means with the same superscript are not significantly different

Table 13: Mineral concentrations of the edible portions at harvest age of 5,7 and 9 was(weeks after sowing) in mg/L. Mean value ± SD of triplicate result

Sample Age	K	Na	Fe	Mg	Ca
Amaranth 5WAS	$300.51^{a}\pm1.00$	$35.14^{a}\pm1.00$	$13.05^{b}\pm1.00$	$65.93^{d}\pm1.00$	$26.37^{de}\pm1.00$
Amaranth 7WAS	$261.55^{c}\pm1.00$	$33.06^{b}\pm1.00$	$14.73^{a}\pm1.00$	$95.37^{a}\pm1.00$	$38.15^{a}\pm1.00$
Amaranth 9WAS	$241.07^{d}\pm1.00$	$18.08^{g}\pm1.00$	$6.00^{cd}\pm1.00$	$65.74^{e}\pm1.00$	$26.30^{de}\pm1.00$

TIMBOU-AFRICA ACADEMIC PUBLICATIONS
NOV., 2022 EDITIONS, INTERNATIONAL JOURNAL OF:
SCIENCE RESEARCH AND TECHNOLOGY VOL. 11

Celosia 5WAS	290.06^{b}±1.06	33.05^{b}±1.05	11.43^{c}±1.00	62.41^{f}±1.41	24.96^{ef}±1.06
Celosia 7WAS	267.23^{c}±1.23	34.21^{b}±1.21	9.87^{c}±1.00	58.89^{c}±1.80	23.56^{cd}±1.56
Celosia 9WAS	238.15^{i}±1.15	34.23^{h}±1.23	9.87^{e}±1.00	69.44^{g}±1.44	27.78^{h}±1.08

SD= Standard Deviation

Means with the same superscript are not significantly different

Table 14: Antioxidant composition measurements at different ages of harvest; 5, 7 and 9 was (weeks after sowing) in mg/g. Mean value ± SD of triplicate result

Sample Age	Total phenolic	Flavanoid	VitaminE	Vitamin A	Vitamin B_2
Amaranth 5WAS	0.17^{b}±0.01	0.25^{b}±0.01	0.07^{a}±0.00	0.76^{b}±0.01	0.07^{a}±0.00
Amaranth 7WAS	0.25^{b}±0.01	0.28^{b}±0.01	0.07^{a}±0.00	0.72^{b}±0.01	0.07^{a}±0.00
Amaranth 9WAS	0.26^{b}±0.01	0.17^{b}±0.01	0.07^{a}±0.00	1.23^{b}±1.00	0.07^{a}±0.00
Celosia 5WAS	0.78^{b}±0.01	0.41^{b}±0.01	0.07^{a}±0.00	0.83^{b}±0.01	0.08^{a}±0.00
Celosia 7WAS	0.45^{b}±0.01	0.77^{b}±0.01	0.11^{a}±0.01	0.86^{b}±0.01	0.10^{a}±0.01
Celosia 9WAS	0.55^{b}±0.01	0.96^{b}±0.01	0.10^{a}±0.01	1.46^{b}±1.00	0.12^{a}±0.01

SD= Standard Deviation

Means with the same superscript are not significantly different

Table1WAS5: Antinutrient concentrations of the leaves (mg/g) of dry matter. Mean value ± SD of triplicate result

Sample Age	Saponin	Tannin	Oxalate	Phytate
Amaranth 5WAS	0.34^{bc}±0.01	0.08^{b}±0.00	0.16^{a}±0.01	1.22^{de}±1.00
Amaranth 7WAS	0.54^{a}±0.01	0.14^{b}±0.01	0.15^{a}±0.01	2.07^{cd}±1.00
Amaranth 9WAS	0.37^{abc}±0.01	0.09^{b}±0.00	0.13^{a}±0.01	1.34^{cde}±1.00

Celosia 5WAS	$0.12^{d}\pm0.01$	$0.32^{b}\pm0.01$	$0.14^{a}\pm0.01$	$0.72^{de}\pm0.01$
Celosia 7WAS	$0.40^{abc}\pm0.01$	$0.40^{b}\pm0.01$	$0.17^{a}\pm0.01$	$0.19^{e}\pm0.01$
Celosia 9WAS	$0.54^{a}\pm0.01$	$0.64^{b}\pm0.01$	$0.15^{a}\pm0.01$	$0.34^{e}\pm0.01$

SD= Standard Deviation

Means with the same superscript are not significantly different

Discussion

Moisture content

The mean moisture content represented for fresh leaves samples (table11) showed a range of 88.98-86.60% for Amaranth and 92.00-81.75% for celosia. The mean moisture content increased from age 5 WAS to 7 WAS for celosia (90.66 – 92.00%) decreased in 9 WAS (81.75%) and firstly decreased for Amaranth (88.98 -86.60 %) 5-7 WAS and increased slightly from 86.60 % -86.90 % (7 WAS – 9 WAS).

Proximate

The dry leaves moisture content (Table12) shows that the level of moisture in the dry matter of both amaranth and celosia increased but only celosia decreased at the 9WAS with the highest value obtained at 9WAS (12.00mg/L) for Amaranth and 13.00mg/L for celosia at 7WAS.

Plant age at harvest has a greater impact on the protein contents of leafy vegetables (Table 12). The mean protein contents of Amaranth increased till the age of 7 WAS (24.46mg/L -36.32mg/L) and decreased marginally again until the 9th WAS (i.e 36.32mg/L -23.10mg/L). The same trend was observed for Celosia plant with highest level of protein obtained at 5 WAS followed by 5WAS and 9WAS (i.e 38.24mg/L and 24.09mg/L respectively). This is an agreement with the work of Kadoshnikov *et al*. (2005) that amaranthus are excellent sources of protein (17.2 – 32.6mg/L from dry weight of various samples).

Leafy vegetables are deficient in fats and this makes them good for health. Age at harvest has little influence on the crude fat contents of leafy samples (0.54 - 0.85mg/L). However, there was no regular relationship between age at harvest and crude fat contents.

Vegetables are good source of fiber which lowers the body cholesterol level consequently decreases the risk of cardiovascular diseases. The mean fiber content decreased progressively from 5 WAS to 9 WAS for Amaranth (3.5 - 2.5 mg/L). Consequently, the value slightly decreased as the plant age increased for Celosia (3.00mg/L- 2.07mg/L) and also decrease throughout the harvest ages (3.00, 2.70 and 2.07) at 5,7 and 9 WAS respectively. These results did not conform with the one reported by Oyeyemi *et al*. (2007) (i.e

16.08mg/g) for amaranth but agreed with that of 1.8mg/g) for Celosia (Islam ,2012).
The plant maturity and age did not significantly affect the ash content of these samples (Table 12). However, the highest level of ash was obtained at 7WAS for amaranth (1.71mg/L) and celosia (1.80mg/L). Conformity was observed when these results were compared to 1.35mg/L and 1.15mg/L for Amaranth and Celosia respectively (Adeniyi *et al*. (2018). Ash is the inorganic residue remaining after water and organic matter have been removed by heating and provides a measure of the total amount of minerals within a food (Md Clement, 2003).
The carbohydrate content of these leafy vegetables was clearly affected by the influence of plant age at harvest (Table 13). The mean value obtained for Amaranth was (60.15, 46.73 and 60.80mg/L) with age 7 WAS showing the lowest mean value. This deviated from the response of Amaranth leaves where age 7WAS shown the latest value. The value obtained for celosia were 55.23mg/L, 43.41mg/L and 59.67mg/L with 9WAS showing the highest. As a matter of fact, these values were in line with the opinion of that carbohydrate may form 50 -80mg/g of the dry matter in the form of non starch polysaccharides.

Minerals
The sodium contents of Amaranth decreased significantly with plant age at harvest (Table 13). Small increment was observed between harvest samples of age 5 and 7 WAS but a great clear differences was observed between harvest samples of age 7 WAS and 9 WAS were compared. The mean value of CHO obtained for *celosia* was 55.23mg/L(5 WAS), 43.41mg/L(7 WAS)and 59.67mg/L(9WAS). However, sodium concentration was maximized at age 5 WAS for Amaranth (35.14mg/l) and at age 5 WAS for Jute plant leaves (27.97mg/L) of dry weight.
The amount of potassium (K) obtained at 5 week after sowing (WAS) was higher than that of both 7 WAS and 9 WAS. This means that the potassium concentration of amaranth decreases with increase in plant age. This follows the trend that, the K content of *celosia* decreases as plant age progresses. This was in agreement with the fact that K content was the highest at the 6th WAS and deviated from the one reported by that K content was highest at the 9th WAS. This could be seen in Table 13. This variation observed indicates that plant maturity contributes to potassium absorption and deterioration in leafy vegetables.
The content value of Iron (Fe) obtained for amaranth were very close to each other at age 5 WAS and 7 WAS (Table 13) and the value obtained at age 9 WAS was the least value (6.00mg/L). The mean value of Iron (Fe) obtained for *celosia* at age 5 WAS and 7 WAS were very close to each other (Table 13) and the value obtained at 7 and 9 WAS respectively.

The Ca content for amaranth was highest at the 7th week after sowing (38.15mg/l). This value was more than that of 5th and 9th WAS. That of *celosia* was highest at 9th WAS.This is in agreement with the report that Ca content for *celosia* was highest at 9th WAS. However, it is likely that older leaves may contain anti –nutrients (e.g oxalate and phylate) that decrease minerals bio-availability to humans.

Magnesium content (Mean value) of Amaranth increased then decreased; with harvest age of 7 WAS having the highest value (95.37mg/L). The magnesium content increased as the plant age increased. (37.33mg/L at 9th WAS). However age at harvest had a very significant impact on the Mg contents of both *celosia* and okra. it decreased then increased for *celosia* and increased then decreased for okra leaves. The result obtained for Mg in this study did not conform with the report that age at harvest did not contribute significantly to the variation in magnesium content of leaves.

Antioxidants

The concentration of vitamin E (tocopherol) was generally low. Table 14 shows that the vitamin E values had the range of 0.07 - 0.11mg/100g for both Amaranth and Celosia. The highest value obtained for Amaranth was at the 5 WAS (0.07mg/100g) and that for Celosia was at the 5th WAS (0.11mg/100g). There was no significant difference in these values at different ages of harvest.

The vitamin A (retinol) contents of both Amaranth and Celosia was highest at the 9th WAS, 1.23mg/100g Amaranth and 1.46mg/100g celosia. This result suggests that more retinol would be found in the leaves of older Amaranth plants and Celosia plants. However, from the perspective of human and animal nutrition, the low palatability and digestibility of older leaves may not favour large amounts of Amaranthus leaf intake but favours Celosia.

Vitamin B2 (riboflavin) also present in Amaranth and Celosia plants (Table 14) but its concentrations were generally low at every harvest maturity stage. No significant difference was observed in the result but still the highest value obtained for Amaranth was at the 7th WAS (0.07mg/100g while that of Celosia was at 9th WAS (0.12mg/100g).

Flavonoid acts as defense and signaling compounds in reproduction, pathogenesis and symbiosis. The result presented in table 14 depicts that to every 100g of dry weight equivalent of the leafy vegetables (*celosia* and Amranth) consumed less than 1 mg is supplied to the body. The maximum value of flavonoid obtained for *celosia* (0.96mg/100g) was at the 9th WAS for *celosia* and that for Amaranths (0.28mg/100g) was at the 7th WAS. With these values, plant maturity had negligible impact on the flavonoid contents of both *celosia* and amaranths leaves. The result was in contrast to that of this study as he detected high level of flavonoid (58.33-69.80mg/100g) in water leaf.

The total phenolic contents of *celosia* and okra leaves (dry matter) were very low (Table 14) with the highest concentration at the 5th WAS (0.78mg/100g) for *celosia* and 0.78mg/100g for amaranths at the 7th WAS.

Anti nutrient

Table 15 shows the result for anti-nutritional components of Amaranth and jute in mg/g of mean value. The result shows that the plants contain low level of anti-nutritional factors ≤5.25 mg/g. The saponin contents of Amaranth reached the highest level at the age of 7WAS (0.537 mg/g) and that of celosia was highest at 9WAS also (0.54 mg/g).

The result for tannins shows that the concentration of tannin in Amaranth was maximized at the 7WAS and the content of tannin in Celosia is high in 9WAS (0.64mg/g). However, tannin in these plants will be lethal if it is ≥ 5%. This value is the agreed value that can complex with other nutrients.

The phytate contents of both plants ranged from 0.19mg/g – 2.07mg/g. This range is higher than that of other antinutrients. However, the effect of age at harvest was a bit significant.

For oxalate contents, the levels are generally less than 1.0mg/g. The influence of age at harvest was not clearly seen. However, the maximum value was recorded for both Amaranth and celosia at the 5WAS showing that increase in age at harvest decreases the concentration of oxalate and older leaves are safe to eat.

CONCLUSION AND RECOMMENDATION

Conclusion

In establishing the optimum time for harvesting of celosia, consideration has to be given to optimum eating quality based on appearance, and biochemical changes of leaves. The result of this study revealed that the proximate compositions of *amaranthus cruentus* and *celosia argenta* were affected by plant age at harvest. The value of protein, crude fat, crude fibre and ash were optimized at the 7Weeks after sowing (WAS) of Amaranth. The moisture content trend was not regular due to erratic rainfall for both fresh and dry sample. The value of protein, crude fat, crude fibre moisture and ash were optimized at the early stage of development of celosia development. The mineral elements K, Na and Fe of both amaranth and celosia decreases as the plant age increases with the exception of Mg and Ca which are highly optimized at the middle harvest time (7WAS) of Amaranth and celosia. The effect of age at harvest on the anti-nutrient contents is less significant and their concentrations were generally low (**<2.1mg/g** for Amaranth and < 1.0mg/g for *celosia*). The antioxidant composition measurements of both Amaranth and jute indicate that the flavonoid and total phenolic were optimized at the 7WAS while Vitamin A, E and

B_2 of both vegetables increases as the plant age progressed. Therefore, the optimum time of harvesting Amaranth is between 6 to 8 weeks after sowing, while that of celosia is anytime from the 7th WAS.

Recommendation

This research recommends that individuals should try the best they can to engage in self vegetable cultivation so as to optimize and target the best nutritious value of intended vegetables.

However, government and non-governmental organization that are working in human nutrition should continue to organize seminars so as to educate people on the effects of age at harvest on the nutritional compositions of leafy vegetables.

REFERENCES

Adeniyi, A., Ayodele, O. D., Akinwumi, A. and Wasiu, S. (2018).Proximate Composition and Fatty Acid Profile of Two Edible Leafy Vegetables in Nigeria. American Journal of Food, Nutrition and Health.Vol:3(2):51-55

Adegbaju, O.D., Otunola, G.A & Afolayan, A.J (2019). Potential of *celosia species* in Alleviating micronutrient Deficiencies and Prevention of Diet – Related chronic Disease. AIMS Agriculture and Food. Vol. 4 (2); pp; 458 – 484

Albert, T. M. (2007). Growth Temperature And Plant Age Influence On Nutritionalquality of *Amaranthus* Leaves And Seed Germination Capacity. Retrieved from: http://www.wrc.org.za

Babalola, O.O., Tugbobo O .S. and Daramola, A.S. (2010). Effect of Processing on the Vitamin C Content of Seven Nigerian Green Leafy Vegetables. Advance Journal of Food Science and Technology, 2(6): 303-305.

Islam, M. (2012). Biochemistry, Medical and food values of Jute leaf: A review. International journal of enhanced Research in science technology & Engineering, vol.2 (2); pp: 35-44. Retrieved from http://www.erpublications.com

Kader, A.A. (2002). Quality and safety factors: definition and evaluation of fresh Horticultural crops. In: Postharvest Technology Of Horticultural Crops, Edited by Kader AA. University of California, Agriculture and Natural Resources, Publication 3311; pp. 279–285.

Kadoshnikov, S. I., Serge, I., Kadoshnikova, I. G. and Martirosyan, D. M. (2005). Investigation of Fractional Composition of the Protein in Amaranth. In Book "Non-Traditional Natural Resources, Innovation Technologies and Products" Issue 12 Moscow. Russian Academy of Natural Sciences, Moscow; 81-104.

Md Clements, D.J. (2003). Analysis of Food Products. Chenoweth Lab., Room 238

Onwordi, C.T., Anuoluwa, M.O and Adedoja, D.W.(2009). The Proximate and Mineral composition of three leafy Vegetable Commonly consumed in Lagos, Nigeria. *African Journal of pure and Applied Chemistry, 3(6): 102-107*

Oyedele, D.J, Asonugbo, C, Awotoye, O.O 2006. Heavy metals in soil and Accumulated by Edible Vegetable after Phosphate Fertilizer Application. *Electron. J. environ Agric. Food Chem. 5(4): 1446-1453.*