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Evaluation of Collected Amaranths Genotypes for Yield, Yield Components and Mineral Compositions at Assosa District in Benishangul Gumuz Region

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Abstract

Amaranths is mostly grown and consumed in the humid area of Oromiya, Benashangul Gumuz, Gambella and SNNPRS. However, amaranths is not popularized and commercialized in our country. The objective of this experiment was to evaluate the yield, yield components and mineral compositions. The experiment was conducted at Assosa agricultural research center in 2018/2019 cropping seasons. The experiment was laid out in RCBD in three replications. Six genotypes of amaranths were evaluated. The analysis of variance showed that no significance difference (P>0.05) among genotypes in terms of yield components and yield. However, there were numerically difference among genotypes in terms of plant height, leaf yield and grain yield. The mineral compositions of genotypes were analyzed. The highest content of essential minerals required for human body was recorded by the genotype of 013/2015. So, tentatively we recommend that the genotype of 013/2015 had good essential minerals for the human body. In future further study should be done over locations and over years.

Keywords: Amaranths; Genotypes; Minerals; Yield

Introduction

The species amaranths belongs to the family of Amaranthaceae and believed to have originated from Central and South America. Amaranth species are cultivated and consumed as a leaf vegetable in many parts of the world. It has been domesticated as leaf vegetables, fodder, potherbs or as ornamentals. Amaranth is one of the most commonly consumed Green Leafy Vegetable (GLV) in households in Osun state, Nigeria. Amaranth is a pseudo cereal with excellent nutritional and functional properties, capable of withstanding extreme climate and soil conditions. Studies done so far indicated that the crop has excellent nutritional profile with high level of protein, minerals and fat as compared to the common utilized cereals [1].

Amaranths a common leaf vegetable in Asia, West Africa. Amaranths belong to the family Amaranthaceae with approximately 60 species that are recognized. Some of the species include Amaranths *hypochondriacus*, Amaranths *hybridus*, *Amaranthus cruentus* and Amaranths *caudatus*. Amaranth was declared as one of the future promising crop to feed the global population. Due to its high nutritional value as well as some agricultural advantages such as relative high grain yield, resistance to drought and short production time, amaranth has got the attention of many researchers [2].

The crop is mostly grown and consumed in the humid area of Oromiya, Benashangule Gumuz, Gambella and SNNPRS [3]. In some places of the country, grain amaranth is fermented to make alcoholic beverage, e.g. tella in Benishangul Gumuz region and another local beverage known as Chaqa in konso. The cooked seeds could also be made into porridge and ground seeds are mixed with teff to prepare pancake like bread (injera) Teketay. Moreover, Amaranths grain is used to prepare bread, spaghetti, breakfast foods, various cakes and cookies. Production and utilization of the crop is not well known in Ethiopia. This might be due to lack awareness in importance of the crop, utilization, lack of improved varieties and agronomic practices. To evaluate the yield and yield components of amaranths spp and to evaluate the mineral contents of collected amaranths genotypes.

Materials and Methods

The experiment was conducted at Assosa Agricultural Research Center (AsARC) in 2017/2018 main cropping season under rain fed condition, in Benishangul Gumuz regional state of Ethiopia. The experimental site is located at 1553 meters above sea level, situated at 4 km east of Assosa town and at 660 km west of Addis Ababa, the capital city of Ethiopia. The study soil was clay loam in texture with strongly acidic in reaction (pH 5.5) [4].

Assosa has unimodal rainfall pattern, which starts at the end of April and extends to mid November, with maximum rainfall received in June to October. The total annual rainfall of Asossa is 1275 mm. The average minimum and maximum temperatures are 14.33°C and 28.43°C, respectively. The dominant soil type of Assosa area is Nitosols and Fluvisols with the soil pH ranges from 5.1 to 6.0.

Treatments and experimental design

The experiment was laid using RCBD with three replications. The total numbers of genotypes were 6 and each plot had a size of 2.4 m^2 areas with four rows and 20 plants per row with a total population of

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80 plants per plot at spacing of 0.30 m and 0.1 m between rows and plants, respectively. The spacing between plots and blocks were 1 m and 1.5 m, respectively [5].

Sampling for plant tissue analysis

Ten plants were randomly selected from plot and leaves were collected from each plant. These samples were air dried at room temperature and then oven dried at 65°C. The leaves were later pulverized using mortar and pestle and were packed in polythene bags [6].

Analysis of minerals composition of amaranths leaf

The mineral elements, comprising sodium, calcium, potassium, magnesium, iron and zinc were determined according to the method of Shahidi and Nahapetian and Bassiri with some modifications. Exactly 2.0 g of each of the processed samples were weighed and subjected to dry ashing in a well cleaned porcelain crucible at 550°C in a muffle furnace.

Data collection

Data on quantitative traits (plant height, leaf yield, leaf length, leaf diameter, number of branches per plant, leaf number per plant were collected from the plot following descriptors developed by the international plant genetic resource institute.

Data analysis

Data was analyzed by statistics 8 version 2.0 software and other related software. Whenever the treatment mean differences were tested using LSD at 5% level of significance and the results were interpreted by Gomez and Gomez.

Results and Discussion

Growth performance and yield components

The analysis of variance revealed that no significance difference (P>0.05) among genotypes in term of plant height, leaf width, leaf number per plant [7]. This result is in line with the finding of Yosef, who reported that, no significance difference among genotypes in leaf number per plant and leaf width. The plant height of amaranth genotypes were ranged between 96 cm to 120 cm. It was statistically no significance difference (P>0.05) among the genotypes while there were numerically difference among the genotypes (Table 1).

Genotypes	pH (cm)	NB	LL	LW	LN
Gen 003/15	120	15.47	12.23a	5.98	92.44
Gen 006/15	120	17.86	10.4ab	5.25	93.78
Gen 007/15	106	16.47	9.65b	5.11	80.33
Gen 008/15	102	16.4	9.77b	4.95	84.11
Gen 009/15	96	13.86	9.45b	4.69	91.89
Gen 013/15	109	15.6	10.68ab	5.43	90.78
Sig Level	Ns	Ns	Ns	Ns	Ns
CV	12.58	12.31	12.41	12.59	25.24
Note: Ns=Non-significant; CV=Coefficient of Variation; PH=Plant Height; NB=Number of Branches; LL=Leaf Length; LN=Leaf Number; LW=Leaf Width					

Table1: Mean of growth performance and yield components of amaranths genotypes in 2019 cropping season.

Leaf and grain yield

The analysis of variance revealed that no significance difference (P>0.05) among the genotypes in fresh leaf yield, dry leaf and grain yields (Table 2). Fresh leaf yield was ranged from 18.81 ton per ha to 37.05 ton per ha, it indicated that there was numerical difference among the genotypes. This result is resembled to the finding of Yosef, who stated that no significance difference among genotypes in leaf yield performance conducted at Melkassa under irrigated condition [8].

Genotypes	FLY (t/ha)	DLY (t/ha)	GY (t/ha)	FSW (t/ha)
Gen 003/15	37.05	5.98	6.82	96.29
Gen 006/15	28.77	6.49	8.44	88.49
Gen 007/15	19.44	4.17	6.45	49.84
Gen 008/15	18.81	4.4	6.44	49.36

Gen 009/15	28.59	6.22	5.68	66.94
Gen 013/15	27.52	5.61	8.05	81.59
Sig Level	Ns	Ns	Ns	Ns
CV	30.14	32.21	28.39	27.67
Note: Ns= Non-significant; CV= Coefficient of Variation; FLW= Fresh Leaf Yield, DLW= Dry Leaf yield, GY=Grain Yield ton per ha				

Table 2: Mean of leaf and grain yield of amaranths genotypes in 2019 cropping season.

Minerals content of amaranths leaf

Amaranthus is considered as a store house for potassium, calcium, particularly iron, zinc, magnesium with an appreciable amount of carotenes and vitamins A-C, which have been investigated for optimum wellbeing [9].

The highest magnesium content (1.827%) of amaranths leaf was recorded by the Gen 013/15 while the lowest magnesium content (1.169%) was scored by the Gen 006/15. The highest calcium content (4.795%) of amaranths leaf was recorded by Acc 013/15 while the lowest calcium content (2.903%) was recorded by Gen 006/15. The highest sodium (0.203%) was observed by the Gen 008/15 while the lowest sodium mineral content (0.001%) was recorded by Gen 007/15 [10]. The highest iron concentration (0.574%) was scored by Gen 003/15 while the lowest iron mineral content (0.116%) was recorded by the Gen 007/15. The highest content (0.0024%) of zinc was recorded by Gen 009/15 whereas the lowest content of zinc (0.0021%) was observed by Gen 013/15. The highest potassium content (2.040%) was recorded by Gen 007/15 while the lowest potassium content (0.997%) was scored by Gen 003/15 (Table 3).

Iron content values are comparable to recommended daily iron intake of 15 mg suggesting that leaves of Amaranth genotypes collected from Benishangul Gumuz are a good dietary source of iron and don't have a side effects [11]. The leaf calcium content levels would meet suggested supplementation in pregnant women of 1500 mg to 2000 mg elemental calcium/day. The results revealed that presence of genotypes with reasonable amounts of calcium and potassium contents were don't have side effect on human being [12].

Similar values for iron, zinc and magnesium were obtained by Akubugwo, however low content for potassium and calcium was also reported. Similar content of calcium content was reported by Makobo however it was at three weeks old contrary to this study which was done at six weeks old [13]. The variation of the results of different studies could also be due to different genotypes, farming practices, methods for analysis, soil types and environmental conditions the genotypes were growing. The differences in mineral composition in leaf and grain reported by various researchers may be attributed to differences in genotypes and agro ecological areas various genotypes are adapted. Mohammed and Sharif argued that differences in mineral content of vegetable plants might be due to soil composition or rate of uptake of minerals by individual plants of specific genotypes.

Genotypes	**Minerals content of amaranths leaf**					
	Mg %	**Na %**	**K %**	**Ca %**	**Fe %**	**Zn %**
Gen 003/15	1.305	0.006	0.997	2.938	0.574	0.0023
Gen 006/15	1.169	0.016	1.036	2.903	0.398	0.0023
Gen 007/15	1.207	0.001	2.040	3.607	0.16	0.0023
Gen 008/15	1.778	0.203	1.831	3.517	0.175	0.0023
Gen 009/15	1.319	0.021	1.213	3.093	0.116	0.0024
Gen 013/15	1.827	0.112	1.362	4.795	0.281	0.0021
Mean	1.43	0.06	1.41	3.47	0.28	0.0023

Table 3: Minerals contents of amaranths leaf at Assosa in 2018 cropping season.

Conclusion

In all parameters the analysis variance revealed that no significance difference (P>0.05) among genotypes in terms of yield and yield components. However, numerically there are difference among the genotypes in terms of plant height, fresh leaf and grain yields. Mineral compositions of genotypes were good source of dietary and the content of minerals was fair for human consumption. Based on mineral composition, genotype 013/2015 had the highest content of calcium, magnesium, sodium as compared to other genotypes. So, we conclude that genotype 013/2015 recommended tentatively in terms of minerals composition. In future the experiment will have to be done across locations and over years.

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References

1. Akubugwo IE, Obasi NA, Chinyere GC, Ugbogu AE (2007) Nutritional and chemical value of *Amaranthus hybridus* L. leaves from Afikpo, Nigeria. Afr J Biotechnol 6: 2833-2839.
2. Capriles VD, Coelho KD, Guerra-Matias AC, Areas JAG (2008) Effects of processing methods on amaranth starch digestibility and predicted glycemic index. J Food Sci 73: H160-H164.
3. Gamel TH, Linssen JP, Mesallam AS, Damir AA, Shekib LA, et al. (2006) Effect of seed treatments on the chemical composition of two amaranth species: oil, sugars, fibres, minerals and vitamins. J Sci Food Agric 86: 82-89.
4. Makobo ND, Shoko MD, Mtaita TA (2010) Nutrient Content of Vegetable Amaranth (*Amaranthus cruentus* L) at Different Harvesting Stages. World J Agric Sci 6: 285-289.
5. Mustafa AF, Seguin P, Gelinas B (2011) Chemical composition, dietary fibre, tannins and minerals of grain amaranth genotypes. Int J Food Sci Nutr 62: 750-754.
6. Nahapetian A, Bassir A (1975) Changes in concentration and interrelationships of phytate, P, Mg, Cu, Zn in wheat during maturation. J Agric Food Chem 32: 1179-1182.
7. National Research Council (2002) Underexploited tropical plants with promising economic value. The Minerva Group, Inc., USA, pp. 200.
8. Pedersen B, Kalinowski LS, Eggum BO (1987) The nutritive value of amaranth grain (*Amaranthus caudalus*). Plant Foods Hum Nutr 36: 309-324.
9. Segura-Nieto M, Barba del la Rosa AP, Paredes-Lopez O (1994) Biochemistry of amaranth proteins. Amaranth Biology, Chemistry, and Technology, 1st Edition, CRC Press (Taylor and Francis group), USA, pp. 75-106.
10. Shahidi F, Chavan UD, Bal AK, Mckenzie DB (1999) Chemical Composition of Beach Pea (*Lathyrus Maritimus* L.) Plant parts. Food Chem 64: 39-44.
11. Teketay D, Feyera S, Mark M, Million B, Pia B (2010) Edible Wild Plants in Ethiopia, Addis Ababa University Press, Ethiopia, pp. 114-115.
12. Yosef A, Samuel T (2018)Performance of Amaranth (*Amaranthus Cruentus* L.) Genotypes for Leaf Yield in Ethiopia. J Biol Agric Health. 8: 3208.
13. World Health Organization (2013) Guidelines: Calcium supplementation in pregnant women, WHO, Geneva pp. 1-30.