Effect of Moisture on Yield and Quality of Amaranths in Meru DC, Tanzania

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INTRODUCTION

Amaranth (*Amaranthus* spp.) is common African tradition vegetable (ATV). It has been cultivated as a leaf vegetable, grain or ornament for decades. In Tanzania, amaranth is a key vegetable but the average consumption of vegetables is only 40kg dry wt./person/year (Ruel et al.,2005) against the world minimum recommended 73kg dry wt./person/year (Engle et al. 2003; Ojiewo et al. 2014) partly due to poor availability because of low production. Soil moisture is known to cause low leaf, grain yield and nutritional quality. This information is limited in

OBJECTIVE: To evaluate the performance of amaranths entries in vegetative and grain yields and nutritional qualities under different soil moisture regimes.

MATERIALS AND METHODS

Experiments were carried out at World Vegetable Center Eastern and Southern Africa in Arusha from April to August 2018 whereby 3 irrigation frequencies (once every two weeks (IF1), once every week (IF2) and twice a week (IF3) (main-plot) were tested against six amaranth entries AH-TL-Sel and 'Mchicha' (*Amaranthus hypochondriacus*), Bresil-sel, 'Madiira 1' and 'Madiira 2' (*A. cruentus*) and a local cultivar with 4 replications (Plate 1). Seeds were sown and transplanted 21 days after emergence into 10L pots having a soil: Sand: FYM mixture in a 3:2:1 ratio (see plate 2) and irrigated with 0.5L/pot using a hand watering can (evenings) but adhering to the tested irrigation frequencies.

Records were taken on weight of marketable yield, grain yield, and quality as crude protein and Fe. Data analyses was done using Genstad Software (Version 20)

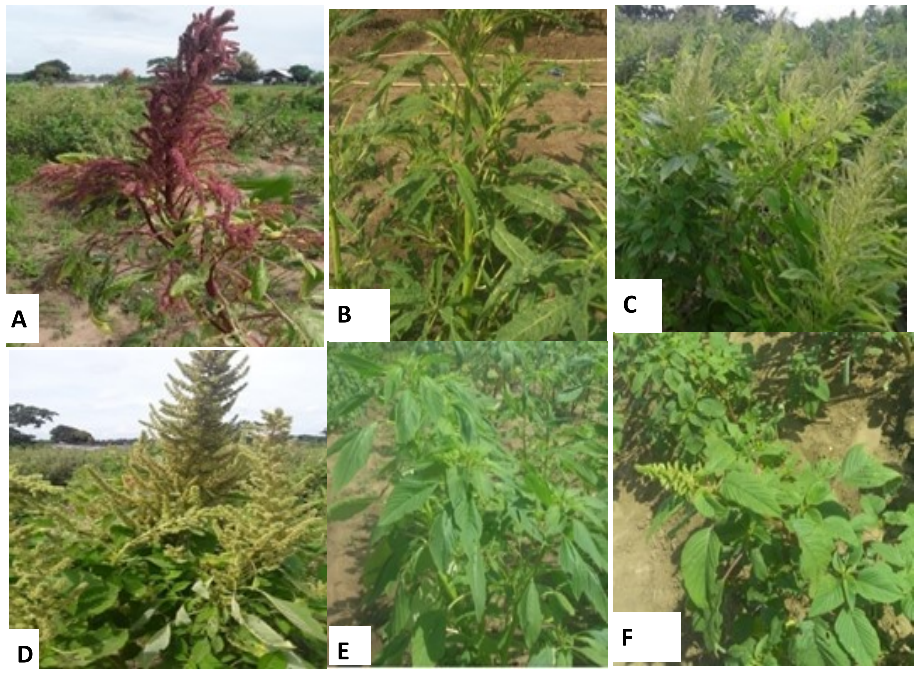

Fig 1. Pictures of the six amaranth entries, BRESIL (B)-Sel (A), 'Madiira 1' (B), Mchicha (C), AH-TL-Sel (D), 'Madiira 2'(E) and Local (F), evaluated.

Fig 2. Experimental plots/pots with potting media and the experimental layout

RESULTS AND DISCUSSION

Irrigation frequencies and entries main effects as well as their interactions were highly significant on dry marketable vegetable yield and grain yield (Tables 1-3). 'Madiira 2' and Local did not significantly differ as well as AH-TL-Sel and Mchicha (Table 1). The highest dry marketable yield was produced by 'Madiira 2' followed by local and then Madiira 1 at 12.0, 11.2 and 10.2 kg/plant respectively. The lowest yields were obtained from BRESIL (B)-Sel, Mchicha and AH-TL-Sel with 13.2 g, 10.4 and 9.1 g/plant, respectively (based on IF3). The opposite was true in grain yield whereby the highest grain yields were obtained from AH-TL-Sel, Mchicha and BRESIL (B)-Sel with 16.9, 16.7 and 14.2 g/plant, respectively while 'Madiira 1', 'Madiira 2' and the Local cultivar produced the lowest grains yields, 9.8 g, 5.9 and 4.5 g/plant, respectively (Table 2). Plants irrigated twice every week (IF3) gave the highest vegetable and grain yields.

Irrigation frequency				
Genotype	IF1	IF2	IF3	Mean
AH-TL-Sel	13.29	10.31	24.74	16.11
BRESIL (B)-Sel	26.25	12.31	14.72	17.76
Local	21.77	10.19	15.35	15.77
Madiira 1	17.88	13.05	17.97	16.30
Madiira 2	8.64	17.07	16.49	14.07
Mchicha	13.68	12.41	21.44	15.84
Mean	16.9a	12.6a	18.5a	15.98
LSD G= 6.318			LSD IF= 9.619	

Effect of irrigation frequencies and genotypes on crude proteins in dried amaranth grains

Irrigation frequency				
Genotype	IF1	IF2	IF3	Mean
AH-TL-Sel	184.9	240.3	158.5	194.6
BRESIL (B)-Sel	292.1	173.2	236.9	234.1
Local	241.9	158.8	129.7	176.8
Madiira 1	183.4	236.3	196.7	205.5
Madiira 2	186.2	216.9	281.1	228.1
Mchicha	184.1	254.5	198.1	211.6
Mean	212.1	213.0	200.2	208.4
LSD G= 36.18	LSD IF= 44.73			

Effect of irrigation frequencies and genotypes on Iron Content (mg/100g) in dried amaranth grains

Table 1: Effects of entry and irrigation frequency (IF) on amaranth dry marketable vegetative yield (g/plant) in pot experiment

Entry	Irrigation frequency			Mean
	IF1	IF2	IF3	
AH-TL-Sel	4.915	6.246	9.111	6.758e
BRESIL (B)-Sel	5.412	7.083	13.242	8.579c
Local	7.038	9.181	17.553	11.257a
Madiira 1	5.936	8.685	15.887	10.169b
Madiira 2	6.727	9.824	19.407	11.986a
Mchicha	4.813	6.606	10.423	7.281de
Mean	5.8073c	7.9379b	14.271a	9.338
LSDG=0.969		LSD IF=0.792		

Numbers followed by the same letter in a column/row are not significantly different at P≤0.05

Table 2: Effects of entry and irrigation frequency IF) on amaranth grain yield (g/plant) in pot experiment

	Irrigation frequency			
Entry	IF1	IF2	IF3	Mean
AH-TL-Sel	7.407	10.043	16.908	11.453a
BRESIL (B)-Sel	5.158	6.998	14.168	8.775bc
Local	1.476	2.405	4.545	2.803e
Madiira 1	3.454	5.896	9.784	6.378c
Madiira 2	1.878	2.692	5.631	3.401de
Mchicha	7.089	8.415	16.665	10.723ab
Mean	4.4107bc	6.0751b	11.2839a	7.256
LSD G=1.099		LSD IF=2.024		

Numbers followed by the same letter in a column or row are not significantly different at P≤0.05

Table 3: Combined ANOVA table for grains and dry vegetative yield

Source of variation	Df	Ss	Ms	F	P
Grain yield					
Irrigation frequency (IF)	2	617.14	308.57	37.37	<.001
Genotype (G)	5	808.25	161.65	90.48	<.001
IF×G interaction	10	104.53	10.45	5.85	<.001
Dry marketable yield					
Irrigation frequency (IF)	2	930.24	465.12	246.84	<.001
Genotype (G)	5	274.27	54.85	59.01	<.001
IF×G interaction	10	116.13	11.61	12.49	<.001

Whereas Ss -Sum of square; Ms-Mean square; df-degree of freedom; p-probability

CONCLUSION

The overall results showed that suboptimum irrigation decreased both marketable vegetable and grain yields of all the entries. Accordingly, the entries performed well in twice irrigation per week. The dual type entries, AH-TL-Sel, Mchicha and Bresil-sel, performed well in grain yield under all irrigation levels while the vegetable type varieties, 'Madiira 1', 'Madiira 2' and the Local cultivar, performed well in marketable vegetable yield.

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