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EVALUATION OF COOKING TIMES OF EGYPTIAN AND INTRODUCED COWPEA (*VIGNA UNGUICULATA*) GENOTYPES UNDER DIFFERENT COOKING CONDITIONS

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ABSTRACT

Cooking times of fourteen Egyptian and introduced cowpea genotypes were evaluated under different cooking conditions. Soaking treatments manifested shorter time than unsoaked treatments. Adding sodium bicarbonate or baking powder to soaking and cooking solutions gave more shorter cooking time. Microwaves treatment gave the shortest cooking time than all other treatments and conserved as a new approach. All studied cowpea genotypes and all cooking treatments exhibited significant variations. The blacked colored seeds needed shorter cooking time than the red seeds, while round or small seeds needed longer time to complete cooking. The observed significant differences among the genotypes were reflected to genotypic and phenotypic variations and consequently to high broad sense heritability estimates and to high values of genetic advances. Such estimates suggested the ability to achieve possible improvement in cooking time of cowpea seeds which might eventually reflect on their cooking quality.

Keywords: Cowpea, cooking time, soaking solution, microwaves, heritability.

Introduction

Cooked legumes are one of the most important components of any meals among the African and Indian peoples, especially among vegetarians. Cooking quality of cowpea seeds has given few attention from plant geneticists. These quality criteria are of great importance economically and for consumers taste.

Cooking time is an indication of cooking quality of cowpea, *Vigna unguiculata* walp, seeds. Longer cooking time is associated with a reduction in Hutative value of the cooked seeds and increases in energy and time of cooking. Shorter cooking time is more acceptable and desirable as it reduced duration, energy used and save labor cost (WCC, 2010; Hamid *et al.*, 2016; Bouker, 2018; Negoma, 2018).

The aim of the present investigation is to study the effect of different cooking treatments on cooking time of seeds of fourteen cowpea genotypes, local and introduced, before cooking procedure and the effect of such treatments on seeds cooking quality.

Material and Methods

The plant materials used in this study comprised seeds of fourteen cowpea genotypes, nine Egyptian and five introduced ones. These genotypes were varied in their seeds characters, physically or chemically. The seeds were kindly obtained by personal communication and from researchers and commercial sources.

The study was carried out at private farm and at biochemical laboratory of Genetics Dep., Agric. Fac., Zagazig Univ., during 2018-2019.

Field procedure

The obtained cowpea seeds were sown in the summer season of 2018 at a private farm at Abo-keeper, Sharkia, Egypt. The plants received all normal agronomic practices in order to obtain new seeds and having equal requirements and conditions before subjecting to cooking techniques.

Laboratory procedure

Five grams of cowpea seeds of each genotype were used, and each one represented by three replicates. The seeds were subjected on different treatments before cooking procedure, which consider affecting cooking time. These treatments were:

a- Unsoaked dry seeds

b- Unsoaked toasted seeds

c- Soaked seeds in tap water

d- Soaked in distilled water

e- Soaked seeds in 0.5% sodium bicarbonate solution

f- Soaked seeds in 0.5% baking powder solution.

g- Soaked seeds in tap water and exposed to microwaves for 4 minutes.

All soaking treatments were conducted before cooking for four hours. The samples of each genotype were placed in 250ml conoidal flacks, filled with 100ml cooking solution or water. The flasks closed with aluminum foil covers and rubber binders and placed in boiling water bath. Each genotype was represented by 21 flasks (3 replicates per each treatment). Cooking time was began when cooking solution stated to boiling and recorded till complete cooking. The

seeds were periodically, after 20 minutes, removed from cooking liquid every five minutes and tested. When cooked seeds reached to their desirable tenderness, cooking time was recorded. The optimal time was that corresponding to the softening of 85% of the seeds.

At the end of cooking time, the content of each flask was transferred to puchner funnel to separate cooked seeds from cooked liquid, and the cooked seeds were weightened and put in plastic bag and kept frozen till their examinations. This cooking technique was done according to Yeung (2007) with some modifications in cooking procedure.

The obtained data for cooking time were statistically analyzed for each treatment separately, and their means as well as their least significant differences (L.S.D.) were calculated as described by Sharma (2006). Genotypic (GV), phenotypic (PV) variances, broad sense heritability and genetic advance estimates were also determined as out lined by Bouke (2018).

Result and Discussion

Performance of the studied cowpea genotypes for cooking time of their seeds under different cooking treatments and analysis of variance for such genotypes under such cooking treatments are given in Tables 1 and 2, respectively.

The obtained data showed significant differences among all studied genotypes, or among all cooking treatments, exhibiting considerable genotypic variations and reflecting their different genetic backgrounds. The significant interactions between cultivars, baladi and introduced groups might indicate that each group reacted differently than the others in cooking time. Similar results were obtained by Mashi (2006), Ehlars *et al.* (2009), IYP (2016) and Soka (2019). Dry seed of Azmerligenotype and Variegate Chinese genotype needed longer time to cook, both genotypes had large round seeds. But seeds of kareem 7 needed the shortest time to cook, followed by the Greenish black Baladione. But, high temperature of toasting treatment caused some changes in chemical constitution of cowpea seeds, leading to shorter cooking time compared with that of air dried seeds. The Kareem7 genotype exhibited the shortest cooking time under both unsoaked treatments compared with the other genotypes. Under soaking conditions, the genotype kaha 1 achieved the shortest cooking time while Black Baladi genotypes had similar cooking time and shorter than the white ones.

Similar results were reported by Mashi (2006), Bhokre and Joshi (2015), Wood (2016) and Komara (2018) which agreed with our findings. Adding sodium carbonate or baking powder to soaking and cooking solutions speed up cooking time of all genotypes. Moreover, exposure of soaked seeds to microwaves for four minutes led to speeding up seeds of all cowpea genotypes to cook, showing the shortest time compared with the other treatments, which is considered a new approach in cowpea cooking procedure. It is interest to note that the averages of Baladi group were shorter in cooking time under different cooking treatments, followed by the averages of cultivars group and at least the introduced group which manifested the longest time to cook.

Ranking pattern of the studied cowpea genotypes according to their estimated cooking time under different cooking treatments is given in Table (3). The shortest cooking time genotype gave the highest score (14), while the longest cooking time one gave the less score (1) and the mean rank was estimated. The Kareem7 was ranked first followed by Greenish Black Baladi and Kaha1. But the introduced Variegated Chinese and Buff Chinese were ranked at least. It is important to choose cowpea genotypes having shorter cooking time and accorded major priority in cowpea improvement (Beshir, 2019).

The genetic parameters obtained for cooking time of cowpea genotypes under different cooking treatments are given in Table (4).

Table 1: Performance of the studied cowpea genotypes for seeds cooking time estimated under different cooking treatments in minutes.

No.	Genotypes	Dry seeds	Toasted seeds	Distilled water	Tap water	Sod. bicar-bonate solution	Baking powder solution	Tap water and microwave treatment
Cultivar group								
1	A zmerli	64.0	39.	20.0	17.0	15.0	12.0	8.7
2	Kareem7	23.0	23.3	21.0	16.0	13.0	11.0	5.0
3	Kafr-EL Sheakh1	45.0	38.0	21.0	17.0	13.0	10.0	7.0
4	Dokki 331	44.0	34.3	20.0	19.0	15.0	10.0	6.0
5	Kaha1	40.7	30.0	17.0	15.0	12.0	8.0	4.0
Average		43.43	32.92	19.80	16.80	13.60	10.20	6.14
Baladi group								
1	White Baladi	47.7	8.0	18.0	17.0	12.0	10.0	4.0
2	Red Baladi	48.0	27.0	17.0	16.0	14.0	12.0	5.3
3	Black Baladi	47.0	30.0	16.0	15.0	13.0	11.0	5.7
4	Greenish Black Baladi	32.7	24.0	16.0	14.0	11.0	10.0	3.0
Average		43.85	27.25	16.75	15.50	12.50	10.75	4.50
Introduced group								
1	White Barazilian	50.0	32.0	24.0	21.0	13.0	11.0	8.0
2	Black Chinese	47.0	33.0	28.0	25.0	19.0	16.0	9.7
3	Purple Chinese	40.0	33.0	23.0	20.0	13.0	10.0	8.0
4	Buff Chinese	37.0	36.0	30.0	26.0	18.0	18.0	13.0
5	Variegate Chinese	61.7	54.0	34.0	29.0	26.0	22.7	20.0
Average		47.14	37.60	27.80	24.20	17.80	15.54	11.74
LSD at 0.05		1.988	2.014	1.347	1.406	1.094	1.476	1.283

Table 2: Analysis of Variance of the studied Cowpea genotypes for seeds cooking time estimated under different cooking treatments in minutes.

Source of Variations	df	MS. Of the studied Cowpea Characters						
		Un soaked		Soaked seeds in				
		Dry seeds	Toasted seeds	Distilled water	Tap water	Sod. bicar-bonate solution	Baking powder solution	Tap water and microwave treatment
Genotypes	13	251.211*	177.0494	91.467*	63.907*	46.236*	47.035*	56.410*
Cultivars	4	393.167*	123.8999	9.600*	6.600*	6.400*	9.100*	9.767*
Baladi	3	170.556*	18.7501	2.750*	5.000*	6.333*	4.083*	4.556*
Introduces	4	279.767*	258.9001	62.600*	41.100*	87.100*	81.267*	76.567*
CultivsBaladi	1	31.666*	767.1852	112.667*	52.667*	52.6678*	50.667*	70.519*
(Culti,baladi) vs Intr.	1	30.671*	982.6079	779.355*	258.466*	155.405*	184.069*	329.815*
Replicates	2	0.167	0.0238	0.649	0.929	0.500	0.310	0.452
Error	26	1.397	1.4341	0.643	0.698	0.423	0.771	0.581

*Significant at 0.05

Table 3: Ranking pattern of the studied cowpea genotypes according to their cooking time under different cooking treatments

Genotypes	Unsoaked seeds		Soaked seeds in					Mean rank
	Dry seeds	Toasted seeds	Distilled water	Tap water	Sod. bicar-bonate solution	Baking powder solution	Tap water and microwave treatment	
Local genotype								
A zmerli	1	2	6	9	6	7	6	5.28
Kareem7	13	14	8	14	11	14	14	12.57
Kafr-EL Sheakh1	8	3	8	9	11	13	7	8.43
Dokki 331	9	5	9	6	6	13	8	8.00
Kaha1	10	10	12	13	13	8	13	11.28
White Baladi	5	11	10	9	13	13	13	10.57
Red Baladi	4	12	12	11	4	7	10	8.57
Black Baladi	7	10	14	13	14	8	9	10.71
Greenish Black Baladi	14	13	14	11	11	13	11	12.42
Introduced group								
WhiteBarazilian	3	8	4	4	11	8	5	6.14
Black Chinese	7	7	6	3	2	3	3	4.42
PurpleChinese	11	7	5	5	11	13	5	8.14
Buff Chinese	12	4	2	2	3	2	1	3.71
VariegateChinese	2	1	1	1	1	1	2	1.28

Table 4: Derived genetic parameters for cooking time of the studied cowpea genotypes under different cooking treatments

Genetic parameters	Cooking treatments						
	Unsoaked seeds		Soaked seeds in				
	Dry seeds	Toasted seeds	Distilled water	Tap water	Sod. bicar-bonate solution	Baking powder solution	Tap water and microwave treatment
Cultivars group							
Gv	131.06*	41.29*	3.20*	2.20*	2.13*	3.33*	3.26*
Pv	131.53*	41.77*	3.42*	2.43*	2.27*	3.59*	3.45*
hb^2 %	99.64	98.85	93.56	90.53	93.83	92.76	94.49
GA at 10%	20.03	11.24	3.13	2.59	2.55	3.19	3.16
Baladi group							
Gv	56.85*	6.25*	0.92*z	1.67*	2.11*	1.36*	1.52*
Pv	57.32*	6.73*	1.13*	1.90*	2.25*	1.62*	1.71*
hb^2 %	99.18	92.87	81.41	87.89	93.78	83.95	88.89
GA at 10%	13.19	4.37	1.68	2.26	2.54	2.04	2.16
Introduced group							
Gv	93.25*	86.30*	20.87*	13.70*	29.03*	27.09*	25.52*
Pv	93.72*	86.78*	21.08*	13.93*	29.17*	27.35*	25.71*
hb^2 %	99.49	99.44	99.00	98.35	99.52	92.29	99.26
GA at 10%	16.89	16.25	7.99	6.48	9.43	8.79	8.84
Over all average							
Gv	93.72*	44.61*	8.33*	5.86*	11.09*	10.59*	10.10*
Pv	94.198*	45.09*	8.54*	6.09*	11.23*	10.85*	10.29*
hb^2 %	99.44	97.05	91.32	92.26	95.71	89.67	94.21
GA at 10%	16.70	10.62	4.27	3.78	4.84	4.67	4.72

* Significant at 0.05 selection differential(k) at 10%=1.75

The observed differences among all cowpea groups for cooking time were reflected into significant genotypic (GV) and phenotypic (PV) variations and consequently to high estimates of broad sense heritabilities which were also reflected to high values of genetic advances (GA). Such high estimates might suggest the ability to achieve possible genetic improvement in cooking time of cowpea seeds which might reflect on their cooking quality. Our results agreed with the findings of IYP (2016), Wood (2016), Asiwe (2018) Komara (2018) and Tongum (2018) who mentioned that heritability estimates for cooking time were high and more than 70%. Interestingly, the black colored seeds appeared to need shorter cooking time than red colored seeds, while round seeds needed long time to cook. Also, small seeds genotypes seemed to take longer time for cooking than the larger seeds.

Moreover, consumption of cowpea seeds might be limited due to the presence of anti-nutriental factors which reduce their availability, soaking the seeds achieved removal such factors before cooking.

Generally, soaking of cowpea seeds before cooking might remove seed pigments and polyphenols and also lead to decrease the risk of flatulence, due to oligosaccharides which are fermented by bacteria resulting gases and soaking leach out such substances. So, Adding a few a mount of ginger to cooking solution might decrease the potential of gas problems.

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