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Evaluation of potential nutrients in *Citrullus lanatus* L. and its wild species

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Abstract
The present investigation was carried out in eighty different genotypes of watermelon including two wild species i.e *C. lanatus* var. *citroides* and *C. colocynthis*. The potential nutrient contents of the pulp, seeds and rind of watermelon were evaluated. The study was carried out dried samples. Results of the investigation revealed that potassium (369.93-8326.2), sodium (38.00-728.17), and zinc (0.03-18.11) has high amount in the most of the genotypes. Although some other minerals were also evaluated but then lower amount as compared to those nutrients. There is a huge variation in the nutrient composition in watermelon genotypes and content reflecting the high selection prospects for these traits to improve the performance through breeding programme.

Keywords: *C. colocynthis, C. lanatus* var. *citroides,* watermelon and nutrient

Introduction

Watermelon [*Citrullus lanatus* var. *lanatus* (Thunb.) Matsum. & Nakai] is a major cucurbitaceous vegetable containing several important health-related compounds including lycopene, citrulline, arginine, and glutathione (Ren *et al*., 2012; Nimmakayala *et al*., 2014b) [1, 2]. Its fruits are diverse in shape, size, rind thickness, rind colour, rind pattern, flesh colour, flesh texture, sugar content, carotenoid, flavonoid, mineral and nutrient composition. Watermelon fruits are becoming an important component of the healthy diet among Indian consumers due to increasing awareness about presence of many healthful compounds and its fruits are now available round the year across the country. Its fruit contains about 93–95% water, 5% carbohydrate, 0.5–1% protein, and 0.2% fat (Rubatzky and Yamaguchi, 1997) [5]. Watermelon has been certified as a heart-healthy food by the American Heart Association because it is low in calories, sodium, cholesterol and fat. The colouring pigment in red-fleshed watermelon is attributed to lycopene which accounts for 70-90% of the total carotenoids in watermelon. Watermelon has become the leader among fresh fruits and vegetables in lycopene which has anti-cardiovascular and anti-cancer properties. Many recently developed red fleshed varieties of watermelon contain 60% more lycopene than tomato (Perkins-Veazie *et al.*, 2001) [3]. Watermelon exceeds tomato in average lycopene content (49 μg/g vs 31 μg/g fresh weight) (USDA National Nutrient Database, 2003) [4]. Watermelon is considered as a ‘mood food’ because of its levels of Vitamin B6, which is used by the body to manufacture different brain chemicals (Neurotransmitters), such as serotonin, melatonin and dopamine, which preliminary studies show helping the body to cope up with anxiety and panic. Its rind contains an important natural compound called citrulline, an amino acid that human body makes from food. Citrulline is found in high concentration in the liver which is involved with athletic ability and functioning of the immune system. One of the key functions of citrulline is to produce another amino acid, arginine, which plays an important role in wound healing, detoxification reactions, immune functions, and promoting the secretion of several hormones including insulin and other growth hormones (Flynn *et al*., 2002; Perkins-Veazie *et al*., 2006) [6].

The aim of this research work is to determine some potential nutrients in watermelon genotypes.

Materials and Methods

Plant materials. The study comprised of 80 germplasm of watermelon for mineral contents. It has been introduced from USDA which comprises of global core collection of germplasm collected from different countries of the world mainly from African region of greater diversity. Majority of the germplasm are plant Introductions (PIs) and mostly from egusi watermelon types. Few accessions from *Citrullus lanatus* var. *citroides* and a *Citrullus colocynthis* genotype collected from Bikaner, India have also been included and these are listed in Table 1.1.

Table 1: List of watermelon germplasm

Genotypes	Accession	Accession	Spesies
DWM 4	PI500354	EC801002	*Citrullus lanatus* var. *citroides*
DWM 7	USVL246FR2S5	EC801005	*Citrullus lanatus* var. *lanatus*
DWM 8	USVL200	EC801006	*Citrullus lanatus* var. *lanatus*
DMW9	USVL201	EC801007	*Citrullus lanatus* var. *lanatus*
DMW10	USVL201	EC801008	*Citrullus lanatus* var. *lanatus*
DWM 12	USVL202	EC801010	*Citrullus lanatus* var. *lanatus*
DWM 13	PI392291	EC 801011	*Citrullus lanatus* var. *lanatus*
DWM 15	USVL023	EC 801013	*Citrullus lanatus* var. *lanatus*
DWM 16	USVL020PFR	EC801014	*Citrullus lanatus* var. *lanatus*
DWM 25	USVL024	EC801017	*Citrullus lanatus* var. *lanatus*
DWM 26	PI532670	EC801884	*Citrullus lanatus* var. *citroides*
DWM 27	PI542123	EC801885	*Citrullus lanatus* var. *citroides*
DWM 28	PI482283	EC801976	*Citrullus lanatus* var. *citroides*
DWM 30	PI482334	EC801878	*Citrullus lanatus* var. *citroides*
DWM 32	PI485579	EC801880	*Citrullus lanatus* var. *citroides*
DWM 34	PI532624	EC801882	*Citrullus lanatus* var. *citroides*
DWM 35	PI271775	EC801871	*Citrullus lanatus* var. *citroides*
DWM 36	PI505604	EC801881	*Citrullus lanatus* var. *citroides*
DWM 39	PI299378	EC801875	*Citrullus lanatus* var. *citroides*
DWM 40	PI596676	EC801887	*Citrullus lanatus* var. *citroides*
DWM 41	PI244018	EC801868	*Citrullus lanatus* var. *citroides*
DWM 43	PI270563	EC801869	*Citrullus lanatus* var. *citroides*
DWM 45	PI505584	EC801998	*Citrullus lanatus* var. *lanatus*
DWM 46	PI177327	EC801909	*Citrullus lanatus* var. *lanatus*
DWM 50	PI254741	EC801931	*Citrullus lanatus* var. *lanatus*
DWM 51	PI379256	EC801967	*Citrullus lanatus* var. *lanatus*
DWM 55	PI219691	EC801922	*Citrullus lanatus* var. *lanatus*
DWM 56	PI174106	EC801903	*Citrullus lanatus* var. *lanatus*
DWM 59	PI271981	EC801936	*Citrullus lanatus* var. *lanatus*
DWM 61	PI370424	EC801963	*Citrullus lanatus* var. *lanatus*
DWM 62	PI169274	EC801896	*Citrullus lanatus* var. *lanatus*
DWM 63	PI534591	EC802012	*Citrullus lanatus* var. *lanatus*
DWM 64	PI278028	EC809041	*Citrullus lanatus* var. *lanatus*
DWM 65	PI535948	EC802014	*Citrullus lanatus* var. *lanatus*
DWM 66	PI534533	EC802011	*Citrullus lanatus* var. *lanatus*
DWM 67	PI227205	EC801924	*Citrullus lanatus* var. *lanatus*
DWM 68	PI560024	EC802027	*Citrullus lanatus* var. *lanatus*
DWM 70	PI172786	EC801900	*Citrullus lanatus* var. *lanatus*
DWM 76	PI306367	EC801945	*Citrullus lanatus* var. *lanatus*
DWM 77	PI293766	EC801943	*Citrullus lanatus* var. *lanatus*
DWM 90	PI470249	EC801975	*Citrullus lanatus* var. *lanatus*
DWM 98	PI176916	EC801907	*Citrullus lanatus* var. *lanatus*
DWM 99	PI169237	EC801894	*Citrullus lanatus* var. *lanatus*
DWM 100	PI184800	EC801912	*Citrullus lanatus* var. *lanatus*
DWM 102	PI254740	EC801930	*Citrullus lanatus* var. *lanatus*
DWM 108	PI458739	EC801973	*Citrullus lanatus* var. *lanatus*
DWM 109	PI435991	EC801970	*Citrullus lanatus* var. *lanatus*
DWM 112	PI249008	EC801927	*Citrullus lanatus* var. *lanatus*
DWM 113	PI430615	EC801969	*Citrullus lanatus* var. *lanatus*
DWM 114	PI560002	EC802025	*Citrullus lanatus* var. *lanatus*
DWM 115	PI357736	EC801959	*Citrullus lanatus* var. *lanatus*
DWM 116	PI500301	EC801992	*Citrullus lanatus* var. *lanatus*
DWM 117	PI183398	IC599382	*Citrullus lanatus* var. *lanatus*
DWM 121	PI512399	EC802005	*Citrullus lanatus* var. *lanatus*
DWM 122	PI538888	EC802020	*Citrullus lanatus* var. *lanatus*
DWM 129	PI537269	EC802018	*Citrullus lanatus* var. *lanatus*
DWM 134	PI381734	IC599387	*Citrullus lanatus* var. *lanatus*
DWM 136	PI491265	EC801989	*Citrullus lanatus* var. *lanatus*
DWM 142	PI278020	EC801940	*Citrullus lanatus* var. *lanatus*
DWM 143	PI164685	IC374808	*Citrullus lanatus* var. *lanatus*
DWM 152	PI534596	EC802013	*Citrullus lanatus* var. *lanatus*
DWM 162	PI169232	EC801893	*Citrullus lanatus* var. *lanatus*
DWM 164	PI266027	EC801932	*Citrullus lanatus* var. *lanatus*
DWM 165	PI113326	EC801888	*Citrullus lanatus* var. *lanatus*
DWM 169	PI271778	EC801866	*Citrullus lanatus* var. *lanatus*
DWM 171	PI612451	EC802034	*Citrullus lanatus* var. *lanatus*

DWM 174	PI500313	EC801994	*Citrullus lanatus* var. *lanatus*
DWM 176	PI176923	EC801908	*Citrullus lanatus* var. *lanatus*
DWM 178	PI357716	EC801957	*Citrullus lanatus* var. *lanatus*
DWM 184	PI431579	IC374821	*Citrullus lanatus* var. *lanatus*
DWM 189	PI167059	EC801892	*Citrullus lanatus* var. *lanatus*
DWM 195	PI169282	EC801897	*Citrullus lanatus* var. *lanatus*
DWM 196	PI532723	EC802009	*Citrullus lanatus* var. *lanatus*
DWM 197	PI180426	IC599380	*Citrullus lanatus* var. *lanatus*
DWM 201	PI270551	EC801935	*Citrullus lanatus* var. *lanatus*
DWM 203	PI381704	IC599384	*Citrullus lanatus* var. *lanatus*
DWM 204	PI179234	EC801911	*Citrullus lanatus* var. *lanatus*
DWM 208	PI246559	EC801926	*Citrullus lanatus* var. *lanatus*
DWM 210	Indian collection from Bikaner		*Citrullus colocynthis*
Sugar Baby	Sugar Baby	Sugar Baby	*Citrullus lanatus* var. *lanatus*

Collection of sample

The eighty germplasm of watermelon introduced from USDA which comprises of global core collection of germplasm collected from different countries of the world mainly from African region of greater diversity. Majority of the germplasm are plant introductions (PIs) and mostly from egusi watermelon types and a few accessions from Citrullus lanatus var. citroides and a Citrullus colocynthis genotype collected from Bikaner, India. The experiment was laid out in randomized block design with 80 treatments and three replications. The recommended package of practices was followed. Necessary plant protection measures were carried out uniformly to protect the germplasm lines.

Mineral analysis

a. Sample preparation

Fresh watermelon fruit samples were collected from each replication for determination of mineral nutrient contents from 80 genotypes of watermelon. These samples were washed in tap water and double-distilled water. The cleaned fruit samples were separately packed in labeled cotton bags and dried in a hot air oven at temperature of 70oC. Then, the dried sample was grinded with the help of a Willey mill. These grind materials samples were stored in air tight containers and diacid digested for nutrient analysis.

b. Digestion of sample

Collected fruit samples were digested in wet diacid by using nitric acid (HNO3) and perchloric acid (HClO4) in the ratio of 9:4. Precisely weighed 0.5g ground sample was taken in conical flask (100 ml) and 10 ml of diacid was added with the help of a tilt pipette. A funnel was put over the flask and kept overnight. Then, the flasks were placed on hot plate in the digestion chamber at a temperature of 100˚C for the initial 1 hour. The temperature was increased to 200˚C for 2-3 hours till the volume was reduced to 2-3 ml and/or the solution turned colourless with cessation of emission of white fumes from the digesting samples. The digested material was then filtered through Whatman No.1 filter paper and diluted. The final volume was made to 100 ml with double distilled water the nutrients such as potassium, calcium, sodium, magnesium, iron, copper, zinc and manganese has estimated.

Citrullus lanatus

Citrullus colocynthis

Estimation of potassium (K) and sodium (Na)

Potassium and Sodium was estimated by using Systronics flame photometer 128, India Limited with facility of internal calibration. The potassium content in the fruit samples was estimated by flame photometer and calculated by multiplying the flame photometer reading with the dilution factor and expressed in mg/100g.

Estimation of micronutrients (Zn, Mn, Cu, Fe, Mg and Ca)

Different micronutrients like copper, iron, manganese, calcium, magnesium and zinc content in plant sample were estimated from diacid digested fruit samples by using Inductively Coupled Plasma Mass Spectrometry or ICP-MS (Model NexION 300X, Perkin Elmer, USA). The concentration of micronutrients was multiplied by dilution factor and expressed in mg/100g.

Result and Discussion

Analysis of variance

The results of the analysis of variance for mineral contents in eighty watermelon genotypes were found to be high critical differences (CD) at 1% in sodium and potassium were 37.981 and 375.73 respectively. The coefficient of variation (CV) % of manganese and copper were found to be high such as 18.975 and 17.901 respectively and sodium and potassium were lesser amount as shown in the table 2.

Mean performance of genotypes for nutritional traits

Mean performance pertaining to 8 characters related to mineral composition of 80 watermelon genotypes is presented in table 3.

Sodium (mg/100g)

Sodium content in watermelon fruits presented in the figure and ranged about 20 times from 38.00 to 728.17 mg/100g. The highest sodium content was recorded by the fruits of DWM 164 (728.17 mg) and lines in descending orders were DWM 40 (453.27 mg), DWM 63 (424 mg), DWM 36 (401 mg) and DWM 66 (384.67 mg) while minimum was recorded in the fruit of DWM 65 (38.00 mg), and lines in ascending orders were DWM 152 (39.13 mg), Sugar Baby (43.17 mg) and DWM 184 (47.8 mg) with a grand mean of 208.28 mg/100g.Thirty one genotypes recorded higher Sodium content when compared to grand mean.

Potassium (mg/100g)

Similarly the potassium content in fruits were presented in figure and it varies from 369.93 to 8326.2 mg/100g. The highest potassium content was recorded by the fruits of DWM 164 (8326.2 mg) and lines in descending orders were DWM

41 (7144.89 mg), DWM 36 (6232.53 mg), DWM 28 (5897.43 mg) and DWM 196 (5168.7 mg) while minimum content was in the fruits of DWM 184 (369.93 mg) and lines in ascending orders were Sugar Baby (454 mg), DWM 152 (666.77 mg), DWM 65 (681.2 mg) and DWM 203 (948.23 mg) with a grand mean of 2690 mg/100g. Thirty five genotypes recorded higher Potassium content when compared to grand mean.

Zinc (mg/100g)

The figure of the zinc content were shown in the and it ranged from 0.03 to 18.11 mg/100g with a grand mean of 3.52 mg/100g. Maximum zinc content was recorded by the fruits of DWM 129 (18.11 mg) and lines in descending orders were DWM 39 (15.73 mg), DWM 113 (12.95 mg), DWM 115 (12.76 mg) and DWM 100 (10.27 mg) while minimum content was recorded by the fruits of Sugar Baby (0.03 mg) and lines in ascending orders were DWM 210 (0.04 mg), DWM 201 (0.07 mg), DWM 39 (0.09 mg) and DWM 65 (0.1 mg). Forty five genotypes recorded higher Zinc content when compared to grand mean.

Manganese (mg/100g)

Manganese content ranged from 0.007 to 0.155 mg/100g. The highest manganese content was recorded in fruits of DWM 165 (0.155 mg), and lines in descending orders were DWM 112 (0.055 mg), DWM 15 (0.054 mg), DWM 129 (0.04 mg) and DWM 176 (0.035 mg) while minimum content was by the fruits of DWM 164 (0.007 mg), and lines in ascending orders were DWM 114 (0.008 mg), DWM 40 (0.009 mg), Sugar Baby (0.01 mg) and DWM 67 (0.01 mg) with a grand mean of 0.02 mg/100g. Thirty three genotypes recorded higher Manganese content in comparision to grand mean.

Copper (mg/100g)

Copper content varied from 0.003 to 0.155 mg/100g. Maximum copper content was recorded in the fruits of DWM 165 (0.155 mg) and lines in descending orders were DWM 112 (0.058 mg), DWM 129 (0.035 mg), DWM 176 (0.033 mg) and DWM 171 (0.032 mg) while minimum was for the fruits of DWM 34 (0.003 mg) and lines in ascending orders were DWM 164 (0.004 mg), DWM 32 (0.005 mg), DWM 201 (0.006 mg) and DWM 28 (0.007 mg) with a grand mean of 0.0199 mg/100g. Thirty genotypes recorded higher Copper content when compared to grand mean.

Iron (mg/100g)

Similarly the iron content were presented in the figure and it ranged from 0.46 to 2.59 mg/100g with a grand mean of 0.961 mg/100g. The highest iron content was recorded by genotype DWM 115 (2.59 mg) and other lines in descending orders were DWM 113 (2.42 mg), DWM 210 (2.34 mg), DWM 77 (2.32 mg) and DWM 171 (2.01 mg) while minimum was found in fruits of DWM 201 (0.46 mg) and lines in ascending orders were DWM 67 (0.48 mg), DWM 34 (0.53 mg) and DWM 66 (0.56 mg). Thirty two genotypes recorded higher Iron content when compared to grand mean.

Magnesium (mg/100g)

The range of Magnesium content in watermelon fruits was from 0.65 to 4.47 mg/100g. Maximum magnesium content was recorded by the fruits of DWM 12 (4.47 mg) and lines in descending orders were DWM 210 (3.36 mg), DWM 64 (3.48 mg), DWM 189 (3.06 mg) and DWM 987 (3.00 mg) while minimum content was found in the fruits of DWM 40 (0.65 mg), and lines in ascending orders were DWM 121 (0.88 mg), DWM 102 (0.91 mg), DWM 108 (0.95 mg) and DWM 76 (0.97 mg) with a grand mean of 1.675 mg/100g. Thirty three genotypes recorded higher Magnesium content in comparision to grand mean.

Calcium (mg/100g)

Calcium content fruit were shown in the figure and it ranged from 7.55 to 19.92 mg/100g. The highest calcium content in fruit was recorded by the watermelon genotype DWM 45 (19.92 mg) and lines in descending orders were DWM 165 (14.78 mg), DWM 197 (14.03 mg), DWM 132 (14.02 mg) and DWM 32 (13.63 mg) while minimum content was by the fruits of DWM 134 (7.55 mg) and lines in ascending orders were, DWM 114 (7.71 mg), DWM 76 (7.77 mg) and DWM 27 (8.1 mg). Thirty four genotypes recorded higher Magnesium when compared to grand mean 10.45 mg/100g.

Conclusion

The determination of nutritional traits related to mineral contents which reflected presence of high magnitude of variability for nutritional characters among the watermelon germplasm utilized for this study.

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It is my privilege to acknowledge my indebtedness Dr. V. K. Sharma, Senior Scientist, Division of Soil Science and Agriculture Chemistry.

Table 2: Mean performance of watermelon genotypes for mineral content

Genotypes	Sodium (mg/100g)	Potassium (mg/100g)	Zinc (mg/100g)	Manganese (mg/100g)	Copper (mg/100g)	Iron (mg/100g)	Magnesium ((mg/100g)	Calcium (mg/100g)
DWM 4	233.33	2674.73	1.25	0.02	0.01	0.64	1.66	10.51
DWM 7	195.57	3273.53	0.46	0.03	0.02	1.36	2.29	9.47
DWM 8	237.23	1844.90	4.98	0.02	0.01	0.66	1.67	10.86
DWM 9	202.70	2260.20	5.16	0.03	0.02	1.18	1.13	8.95
DWM 10	258.83	2388.00	6.71	0.02	0.02	0.88	1.22	10.34
DWM 12	108.10	1159.80	1.83	0.03	0.01	1.05	4.47	12.75
DWM 13	204.13	3052.57	6.16	0.03	0.01	1.29	2.44	11.69
DWM 15	202.77	2950.40	9.44	0.05	0.01	1.41	1.84	11.27
DWM 16	101.47	2470.90	1.70	0.02	0.02	1.35	1.49	8.46
DWM 25	161.10	2247.40	4.95	0.03	0.02	1.07	1.68	11.00
DWM 26	216.47	2172.10	2.12	0.03	0.01	1.02	1.24	9.60
DWM 27	181.07	3379.73	5.65	0.02	0.02	0.63	1.51	8.10
DWM 28	357.03	5897.43	0.92	0.02	0.01	0.88	1.87	12.12
DWM 30	192.40	2850.17	7.10	0.02	0.02	0.75	2.01	9.46
DWM 32	278.67	1837.37	5.06	0.03	0.01	1.05	2.25	14.02

DWM 34	249.50	5076.63	0.88	0.01	0.00	0.53	1.20	10.81
DWM 35	132.10	3638.80	2.12	0.03	0.01	0.84	1.69	9.71
DWM 36	401.20	6232.53	1.34	0.01	0.01	1.12	1.39	8.68
DWM 39	184.10	1470.13	15.73	0.03	0.02	0.73	0.98	11.17
DWM 40	453.27	4679.50	1.83	0.01	0.01	0.63	0.65	8.48
DWM 41	347.80	7144.89	1.29	0.02	0.01	1.16	2.03	10.68
DWM 43	134.40	2248.23	4.53	0.03	0.02	1.07	1.52	9.89
DWM 45	162.80	1212.07	4.85	0.03	0.03	1.01	1.67	19.92
DWM 46	116.87	1819.37	6.90	0.02	0.02	0.74	1.05	9.20
DWM 50	166.80	2734.20	6.89	0.02	0.02	0.71	2.00	8.69
DWM 51	125.63	2676.00	1.67	0.03	0.03	1.17	1.50	9.41
DWM 55	112.43	2118.90	7.70	0.02	0.02	1.09	1.01	10.12
DWM 56	374.67	4485.50	8.75	0.02	0.02	0.68	1.47	11.23

Table 3: Mean performance of watermelon genotypes for mineral content

Genotypes	Sodium (mg/100g)	Potassium (mg/100g)	Zinc (mg/100g)	Manganese (mg/100g)	Copper (mg/100g)	Iron (mg/100g)	Magnesium ((mg/100g)	Calcium (mg/100g)
DWM 59	188.63	1264.43	0.09	0.03	0.02	0.74	1.33	13.63
DWM 61	369.50	3134.50	0.21	0.02	0.01	0.61	1.13	11.16
DWM 62	132.50	1218.77	5.28	0.01	0.01	0.64	1.04	8.70
DWM 63	424.00	4373.83	0.52	0.01	0.02	1.09	1.72	9.01
DWM 64	152.53	4445.30	4.37	0.03	0.03	1.15	3.48	9.79
DWM 65	38.00	681.20	0.10	0.02	0.02	1.12	1.55	10.76
DWM 66	384.67	1789.70	0.15	0.02	0.02	0.54	1.76	9.01
DWM 67	123.33	1889.77	5.62	0.01	0.01	0.48	1.05	8.45
DWM 68	114.47	3103.17	1.76	0.01	0.01	0.84	1.08	8.87
DWM 70	182.47	1966.60	5.04	0.01	0.01	0.87	1.04	10.00
DWM 76	163.90	2213.63	2.26	0.01	0.01	1.02	0.97	7.77
DWM 77	88.80	1246.63	0.09	0.02	0.01	2.32	1.46	8.29
DWM 90	347.20	2928.13	1.21	0.03	0.03	1.24	2.68	11.40
DWM 98	270.40	2233.97	0.18	0.02	0.02	0.84	3.00	10.17
DWM 99	112.93	2234.73	0.36	0.02	0.02	0.72	1.26	13.09
DWM 100	243.07	2564.45	10.27	0.03	0.03	1.13	1.27	11.57
DWM 102	160.53	3314.53	1.39	0.01	0.01	0.64	0.90	8.37
DWM 108	276.27	2767.03	4.20	0.02	0.02	0.53	0.95	9.60
DWM 109	148.57	1842.60	0.35	0.03	0.03	0.92	1.52	10.34
DWM 112	143.43	2600.80	5.28	0.06	0.06	1.06	1.87	10.50
DWM 113	376.53	4212.10	12.95	0.03	0.03	2.42	2.12	9.29
DWM 114	125.77	3819.57	0.53	0.01	0.01	0.67	1.22	7.71
DWM 115	171.60	3154.40	12.76	0.03	0.03	2.59	1.60	10.25
DWM 116	138.20	1364.71	0.31	0.03	0.03	0.95	2.38	12.47
DWM 117	213.70	3828.10	2.52	0.02	0.02	0.52	1.44	11.90
DWM 121	213.00	1004.03	2.64	0.02	0.02	0.73	0.88	9.48
DWM 122	361.38	3747.23	0.63	0.03	0.02	1.28	1.28	9.47
DWM 134	132.20	1678.87	5.69	0.02	0.02	0.59	1.27	7.55
DWM 129	220.47	2528.07	18.11	0.04	0.04	1.49	1.94	11.02

Table 4: Mean performance of watermelon genotypes for mineral content

Genotypes	Sodium (mg/100g)	Potassium (mg/100g)	Zinc (mg/100g)	Manganese (mg/100g)	Copper (mg/100g)	Iron (mg/100g)	Magnesium ((mg/100g)	Calcium (mg/100g)
DWM 136	116.93	2735.00	5.64	0.03	0.03	0.74	1.76	10.82
DWM 142	308.27	4164.73	2.13	0.03	0.02	1.10	1.97	9.61
DWM 143	88.53	2695.80	0.48	0.02	0.02	0.67	1.78	8.48
DWM 152	39.13	666.77	1.11	0.02	0.02	0.62	1.77	11.42
DWM 162	321.40	2684.10	3.12	0.01	0.01	0.52	1.54	11.63
DWM 164	728.17	8326.20	0.54	0.01	0.00	1.15	1.23	10.46
DWM 165	370.07	2760.00	3.53	0.16	0.16	1.13	2.47	14.78
DWM 169	164.60	1609.10	4.08	0.02	0.02	0.95	1.51	9.78
DWM 171	110.07	1076.67	1.28	0.03	0.03	2.01	1.66	13.59
DWM 174	244.30	1560.73	3.32	0.03	0.03	0.85	2.00	13.41
DWM 176	143.63	2782.83	0.53	0.04	0.03	0.87	2.01	10.21
DWM 178	267.77	2931.83	4.53	0.03	0.03	0.66	2.00	11.03
DWM 184	47.80	369.43	0.28	0.01	0.01	0.77	1.23	8.68
DWM 189	225.70	2803.17	6.32	0.02	0.02	0.87	3.06	10.15
DWM 195	185.53	2587.57	4.23	0.02	0.02	0.66	1.64	10.58
DWM 196	193.53	5168.70	1.06	0.01	0.01	0.57	1.88	9.90
DWM 197	296.10	2701.93	1.68	0.02	0.02	0.86	1.32	14.03
DWM 201	115.40	1216.57	0.07	0.01	0.01	0.46	1.15	9.30

DWM 204	108.33	1400.50	1.11	0.02	0.02	0.57	1.68	10.35
DWM 203	96.97	948.23	0.09	0.01	0.02	0.68	1.88	13.41
DWM 208	265.23	2575.47	3.68	0.02	0.02	0.90	1.47	9.61
DWM 210	199.13	1878.77	0.04	0.03	0.03	2.34	3.63	10.44
Sugar Baby	43.17	454.00	0.03	0.01	0.01	0.56	1.26	8.88
Range	38-728.17	369.93-8326.20	0.03-18.11	0.007-0.155	0.003-0.155	0.46-2.59	0.65-4.47	7.55-19.92
Grand Mean	208.28	2690.00	3.52	0.02	0.02	0.91	1.67	10.45
CD(P=0.05)	28.89	285.88	0.25	0.01	0.01	0.12	0.13	0.48
CD(P=0.01)	37.98	375.73	0.32	0.01	0.01	0.15	0.17	0.63
CV (%)	8.66	6.63	4.43	18.97	17.90	7.73	4.92	2.87

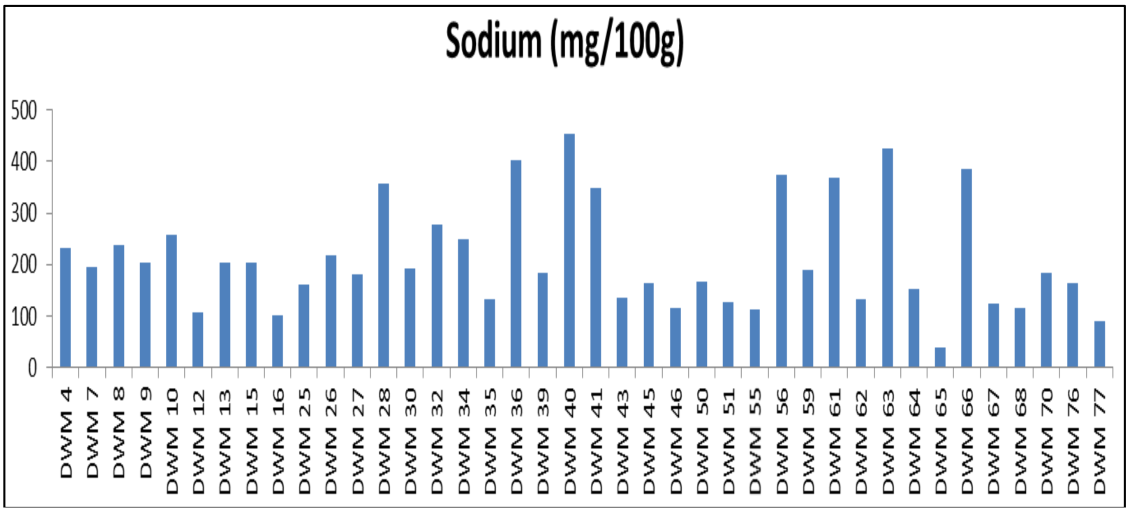

Fig 1: Mean performance of watermelon genotypes (1-40) for sodium content (mg/100g)

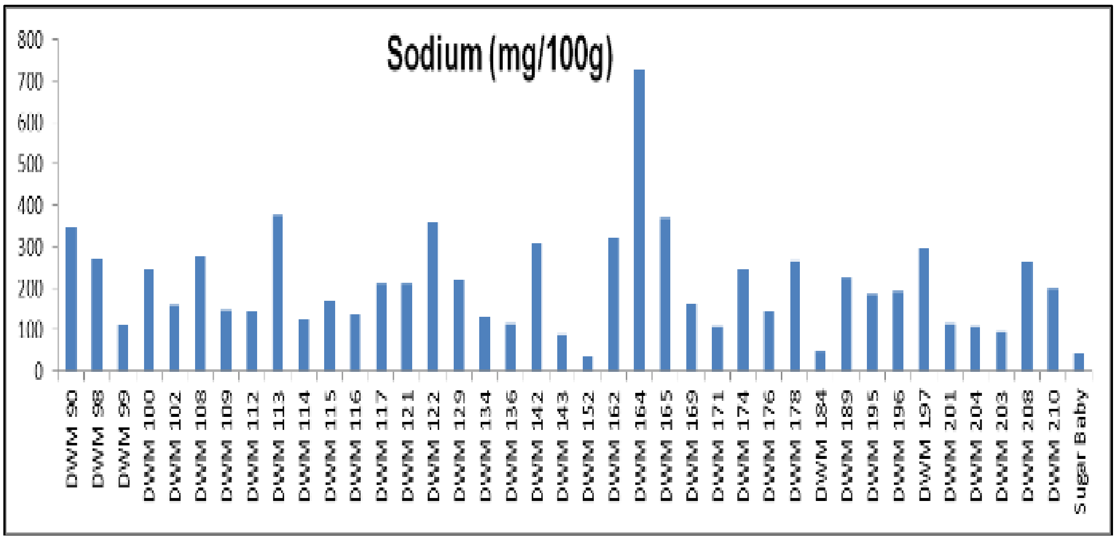

Fig 2

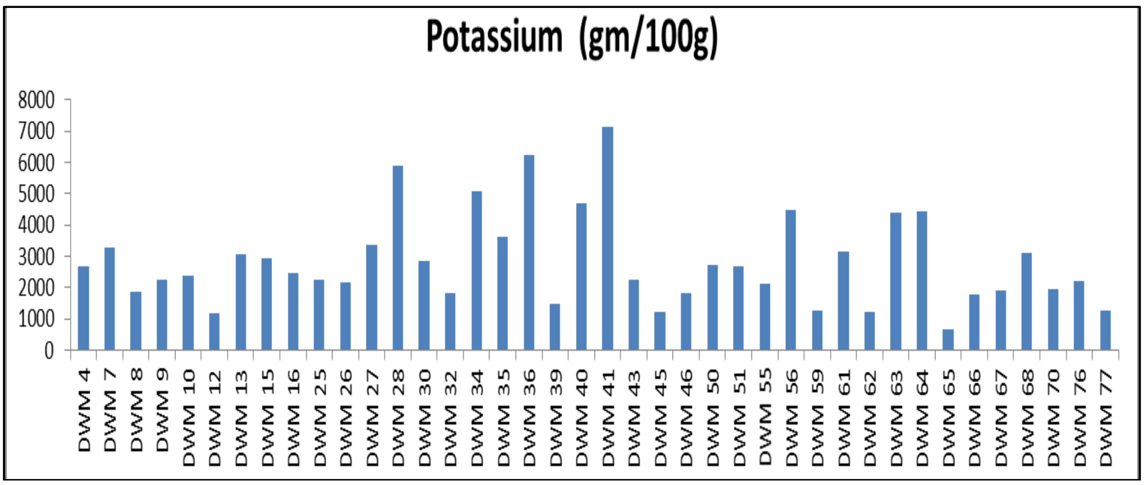

Fig 3: Mean performance of watermelon genotypes (1-40) for potassium content (mg/100g

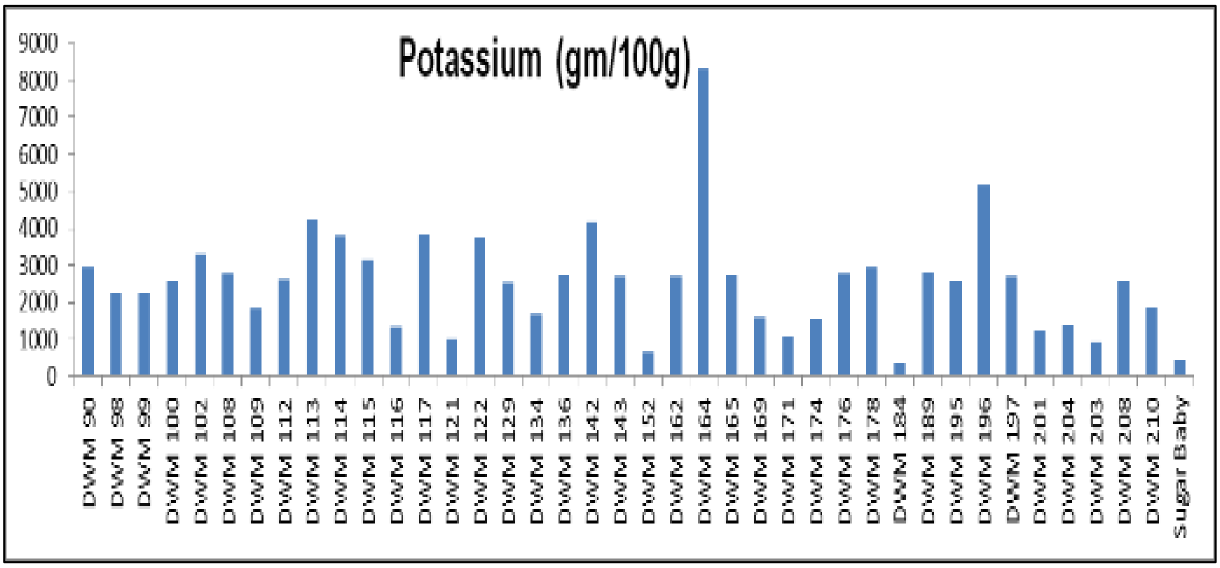

Fig 4: Mean performance of watermelon genotypes (41-80) for potassium content (mg/100g)

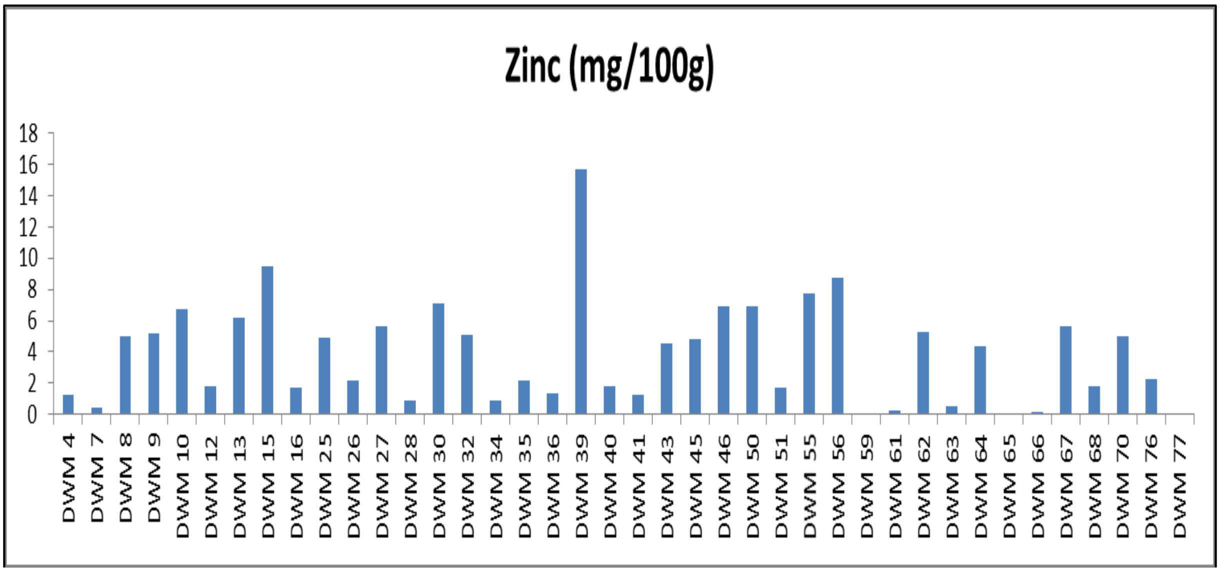

Fig 5: Mean performance of watermelon genotypes (1-40) for zinc content (mg/100g)

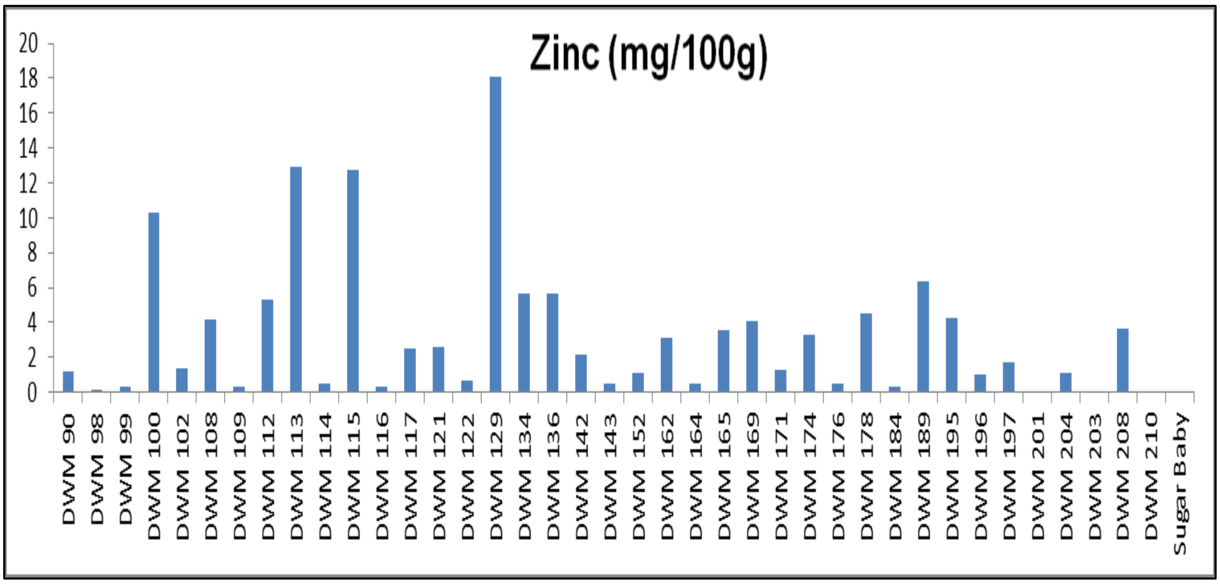

Fig 6: Mean performance of watermelon genotypes (41-80) for zinc content (mg/100g)

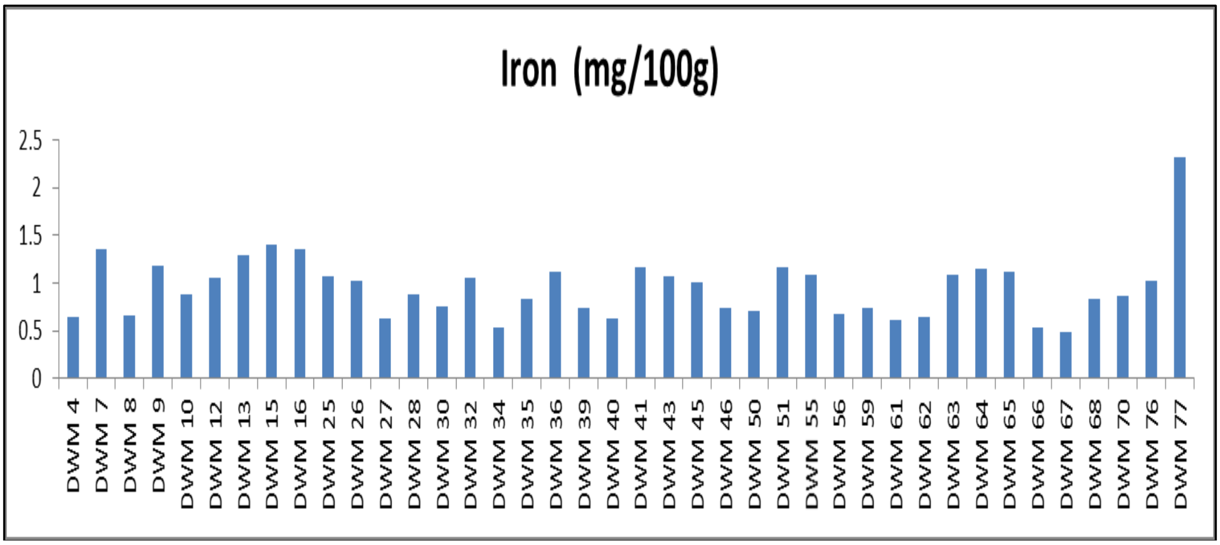

Fig 7: Mean performance of watermelon genotypes (1-40) for iron content (mg/100g)

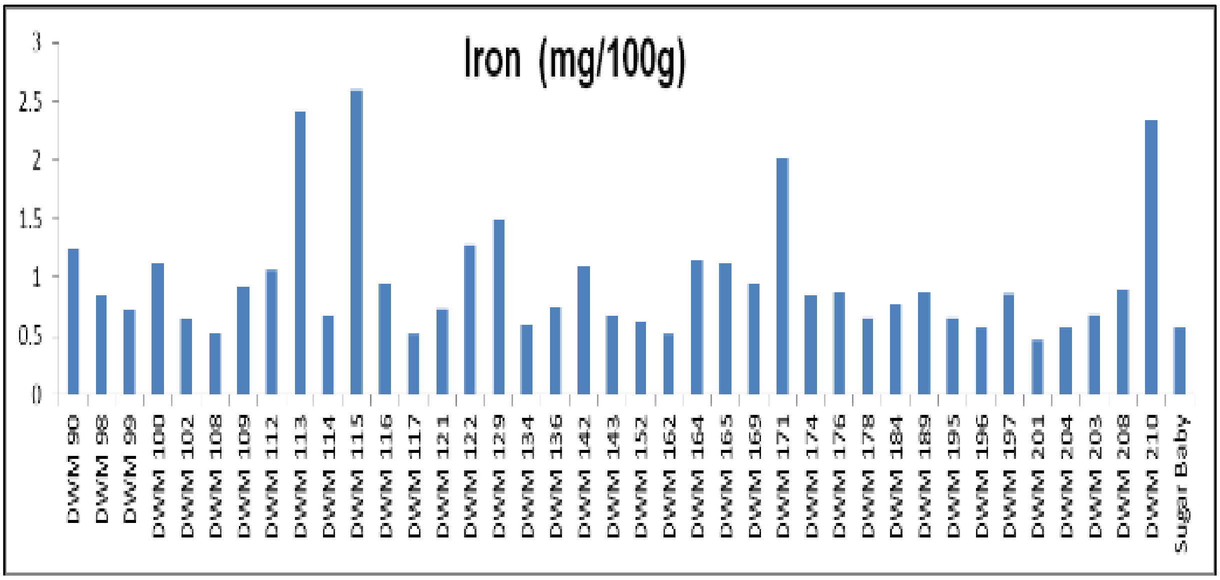

Fig 8: Mean performance of watermelon genotypes (41-80) for iron content (mg/100g)

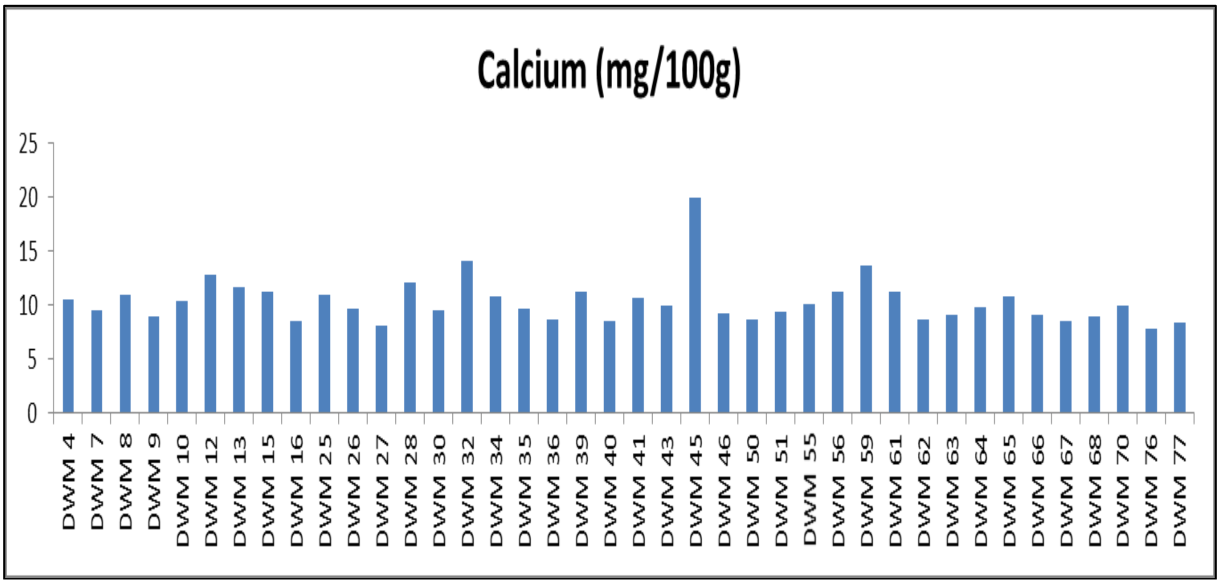

Fig 9: Mean performance of watermelon genotypes (1-40) for calcium content (mg/100g)

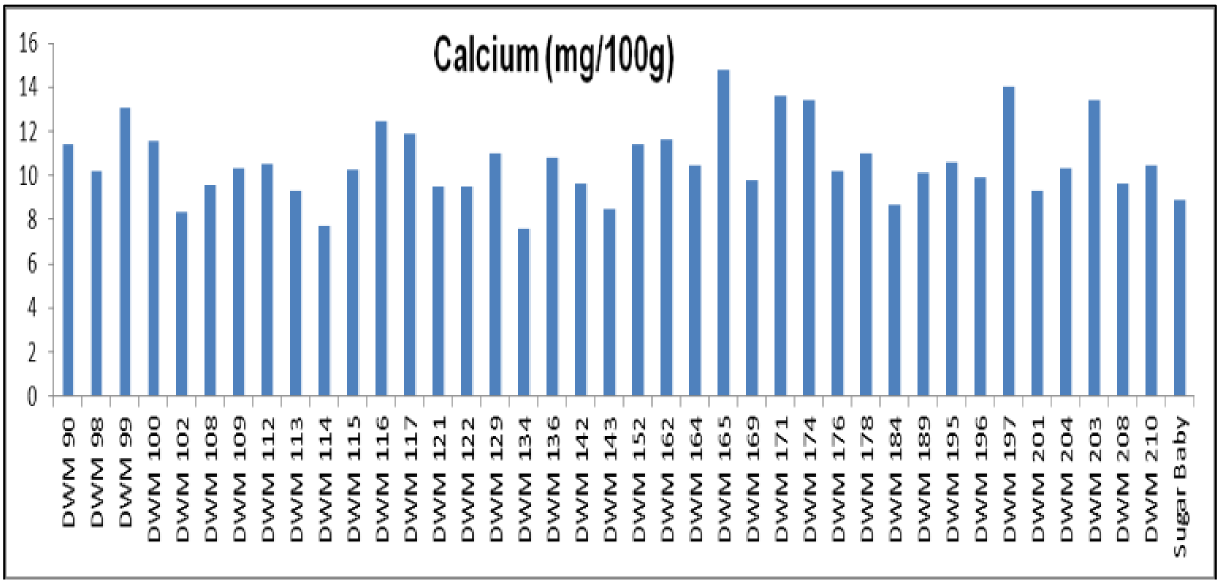

Fig 10: Mean performance of watermelon genotypes (41-80) for calcium content (mg/100g)

Table 5: Analysis of variance for mineral contents in watermelon

	Character	Mean sum of squares			CD (1%)	CV (%)
		Replications (2)	Genotypes (79)	Error (158)		
1.	Sodium (mg/100g)	44.6657	39422.6066	326.096	37.981	8.6699
2.	Potassium(mg/100g)	23615.16	6324818.67	31911.9	375.73	6.64
3.	Zinc (mg/100g)	0.0064	40.7693	0.0244	0.3283	4.4316
4.	Manganese (mg/100g)	0.0004	0.0009	0.0000	0.0093	18.975
5.	Copper (mg/100g)	0.0001	0.0009	0.0000	0.0075	17.901
6.	Iron (mg/100g)	0.0003	0.5718	0.0055	0.1565	7.7380
7.	Magnesium (mg/100g)	0.0080	1.2547	0.0068	0.1735	4.9247
8.	Calcium (mg/100g)	0.0750	11.1768	0.0907	0.6336	2.8800

*Significant at 5 per cent level; ** Significant at 1 per cent level Values in parenthesis indicating degrees of freedom

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