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Evaluation of Nutrient Content of Some Advance Lines of Sesame Seeds

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Abstract

Harvested fresh seeds of twenty-one (21) advance lines of sesame along with their eight (8) parents were subjected to analysis for estimation of its different mineral constituents viz. calcium (Ca), phosphorus (P), manganese (Ma), zinc (Zn), copper (Cu) and iron (Fe). The results depicted that the highest amount of Ca and P found in deep coloured seeds. The advance lines showing better performance were mostly selected as the segregants of the crosses involving at least one high-performance parent. All the constituents studied were estimated in fewer amounts in all the parents and advance lines with white/light coloured seeds in comparison to the genotypes with deep coloured seeds.

Keywords

Mineral constituents, sesame seed, parents and advance lines, macronutrients, micronutrients**.**

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INTRODUCTION

Food insecurity is a global subject of concern especially in developing countries like India (1), where the number of undernourished people is increasing day by day (2). So, it is prime essential to reduce the risk of malnutrition (3). Some indigenous plant species contains high proteins, essential minerals and trace elements with high nutrient values (4). One of such potential plant is sesame which can solve the problem regarding micro-nutrient deficiencies in modern day nutrition.

Sesame (*Sesamum indicum* L.) is one of the most ancient oilseed crops grown in India (5). It is also one of the important multi-season and multipurpose oilseed crops grown throughout tropics and sub tropic (6). Recently this crop has been neglected which resulted into germplasm loss and reduction in variation (6). The total worldwide production of sesame seeds in 2014 was 6,235,530 t, whereas, approx. 25% of the total production was in Africa and about 70% in Asia (7). Sesame oil has various uses in industrial and cultivars. Not only for the production of oil, are some seeds also used for various purposes such as in making sweets, and oil cake as cattle feeding (8). Approx. 35% of the annual production is used for food and 65% is processed to produce oil (9). For that reason, an insight into the estimation of seed mineral nutrient constituents in the existing variation is required. The wide range of variability for various chemical constituents has already been reported by several workers (10,11), but it is necessary to check the mineral constituents in

different varieties (including parents and advance lines) of sesame. Sesame oil contains high fatty acids, linoleic acid, palmitic acid, stearic acid, oleic acid, vit-E, different antioxidant such as sesamin and sesamolin and their derivatives (sesamol and sesaminol) (12). The available literature revealed that there is a shortage of information regarding the mineral nutrients of different varieties of sesame seeds.
Therefore, the present study was to investigate the mineral constituents of some advance lines of sesame seeds in respect to their parents.

MATERIALS AND METHODS
Freshly harvested seeds of 21 stable advance lines of sesame along with their eight parents were utilized far estimation of six mineral constituents: two micronutrients- calcium (Ca) & phosphorus (P) and four macronutrients – manganese (Mn), zinc (Zn), copper (Cu) & iron (Fe). The parental and advance lines were:

(A) Parents | **Seed Colour**

Parents		**Seed Colour**
1.	R-9	Greyish white
2.	B-14	Block
3.	B-9	Brown
4.	B-67	Blackish brown
5.	T-12	White
6.	IDP- 51	Blackish brown
7.	IET-2	Light brown
8.	HT-1	White

(B) Advance lines

Lines	**Parentage**
1.	B-9 × T-12
2.	B-14 × HT -1
3.	HT-1 × B -14
4.	IDP-51 ×T -12
5.	T-12 ×B – 9
6.	IDP-51 ×B- 14
7.	B – 14 ×B- 9
8.	B-9 ×IET -2
9.	B – 9 ×IET-2
10.	T- 12 ×R-9
11.	T- 12 ×IDP -51
12.	B-14 ×IDP -51
13.	R-9 ×IET-2
14.	R-9 ×HT 1
15.	HT-1 ×B -14
16.	IET – 2 ×B-9
17.	B-9 ×HT-1
18.	IET-2 ×R-9
19.	HT-1 ×B-9
20.	R-9 ×T-12
21.	IET -2 ×R-9

Air dried seeds of all the twenty-nine [29] genotypes were oven dried at 60°C till a constant weight is achieved. Then over dried seeds were ground in mortar pastel. Representative samples (1 gm dried power) for each of the genotypes were digested in a.r grade tri-acid mixture of HNO_3 : H2SO4 : HCL in the ratios of 10:1:4 as described by Jackson (1967) (13). The volume of the dig tilled water and stored in plastic container after passing through Whatman 42 filter paper. The concentration of iron (Fe), copper (Cu), zinc (Zn) and manganese (Mn) in the extract were always determined by atomic absorption spectrophotometer (GBC double beam AAS, Model 902) following the condition as mentioned below:

Element	Wave length(nm)	Lamp current (m.A)	Flame type
Fe	248:3	7.0	Air acetylene oxidising
Cu	324:7	3.0	Do
Zn	213:9	5.0	Do
Mn	279:5	5.0	Air acetylene (stoich iometric)

Calcium (Ca) content in the extracts was determined by microprocessor controlled flame photometer (Chemito model 1020).
The spectrophotometric (Visible) determination of phosphorus (P) from the same digested sample was conducted by using a ELICO digital spectrophotometer (Model SLI 71) according to vanadomolybdopharic yellow colour method in Nitric acid system, proposed by Jackson (1967), where the colour is read generally in a spectrophotometer with a light maximum from 400-490 mm, according to the intensity needed. Concentration range of different light maxima is

Range (ppm) of P	Light maximum (hm)

0.75-5.5	400
2.0-15	400
4-17	470
7-20	490

Here, observation was recorded on 470 nm because ferric ion causes interference with the lower wave lengths, particularly at 400 nm. The concentration of P was calculated accordingly from the standard curve.

RESULTS AND DISCUSSION

The results represented that both the micronutrients P and Ca contents were lower in genotypes having seeds with white/light colour in comparison to genotypes with deep coloured seeds (Fig 1 and 2). The maximum Ca percentage was recorded against parent B-67 and IDP-51 and amongst the advance lines, 7 and 9 recorded the same position, both were sleeted from the segregants of parents with deep coloured seeds. The minimum value of both Ca & P was recorded in parents T-12 and HT- 1 as well as in line 14, each of which was white seeded genotypes. On the other hand, the highest phosphorus content was recorded against parent B-14 and lines 2, 7 and 11 segregants of the crosses involving at least one genotype with deep colour seeds. The mean Ca content was noted to be higher than that of P content.

A careful review of the data revealed that all the genotypes differed significantly amongst themselves for the three micronutrients Zinc (Zn), copper (Cu) and iron (Fe) content ranging from 0.0256 to 0.0290, 0.0423 to 0.0479 and 0.1349 to 0.2439 mg/g of seeds respectively (Fig 3, 4 and 5). The Zn content was as high as 0.0290 mg/g of seeds of B-9 followed by B-67 and advance line 7. The lines 5, 6, 7 and 12 with higher Zn content were isolated from the sergeants of the crosses involving at least one parent with high Zn content. The highest Cu content was estimated against advance lines 5 and 8 followed by line 6 and B-67.

All these higher performing lines were also derived from the cross involving at least one parent with high Cu-contents. The maximum iron (Fe) content of 0.2439 mg/g of seeds was estimated against parent 2 (B-14) followed by lines 15, 12 and 2 all being derived from the crosses between B-14 with either HT-1 or IDP-51 (Fig 6). All parents and advance lines with white/light coloured seeds contained fewer amounts of all the genotypes with deep coloured seeds.

In spite of insignificant variation, highest Mn content was estimated against IDP-51 followed by B-9 and advance lines 12 and 17, both the advance lines were initially isolated as recombinants of IDP-51 and B-9 respectively, the higher Mn content parents. Though the seeds were sun-dried uniformly, the moisture holding capacity of the genotypes differed significantly amongst them. Line 21 and IDP-51 recorded the highest (13.00%) and lowest (11.33%) amount of moisture content respectively.

The mean Ca content was higher than that of phosphorus, but the micronutrients occupied the position in order of Fe> Cu> Mn> Zn. The micronutrients Fe, Cu, Zn, and Mn content ranged from 58.6-375.3, 47.9-61.9, 28.3-72.8 and 14.4-24.4 mg/kg of seed respectively. Significant variation was recorded for all four micronutrients and P content in seeds of different varieties. Mohammed et al. (2018) (14) observed that sesame seeds collected from eight Yemen provinces contain calcium ranges from 3.02 to 9.66 mg/kg, potassium 0.824–4.251 mg/kg and magnesium (0.811–4.742 mg/kg).

Aglave (2018) found that sesame seeds are rich in carbohydrate, protein and different chemical properties. Ca, Zn and Fe content was estimated to be 1168.02 – 1222.65 mg/100g, 4.21- 4.52mg/100g and 9.86 – 10.57 mg/100gm respectively (10). According to Ensminger and Ensminger (1994), whole and dehulled Sudanese white and Indiana black sesame seeds contained rich in different nutrients such as fat, protein, ash, crude fibre, and calcium (15). Similar type of results was found by Obiajunwa *et al.* (2005), indicating sesame seeds to be rich in P, K and Ca (11). They also observed significant higher values of iron and zinc (11). On the background of previous reports, it was indicated that sesame seeds are nutritionally enriched. Similar kind results were noted in this study. Furthermore, it was confirming that the nutrient parameters were variable in different parents and advance lines. Among the all 29 different genotype of sesame, deep or black coloured seeds contained higher nutrient enrichment.

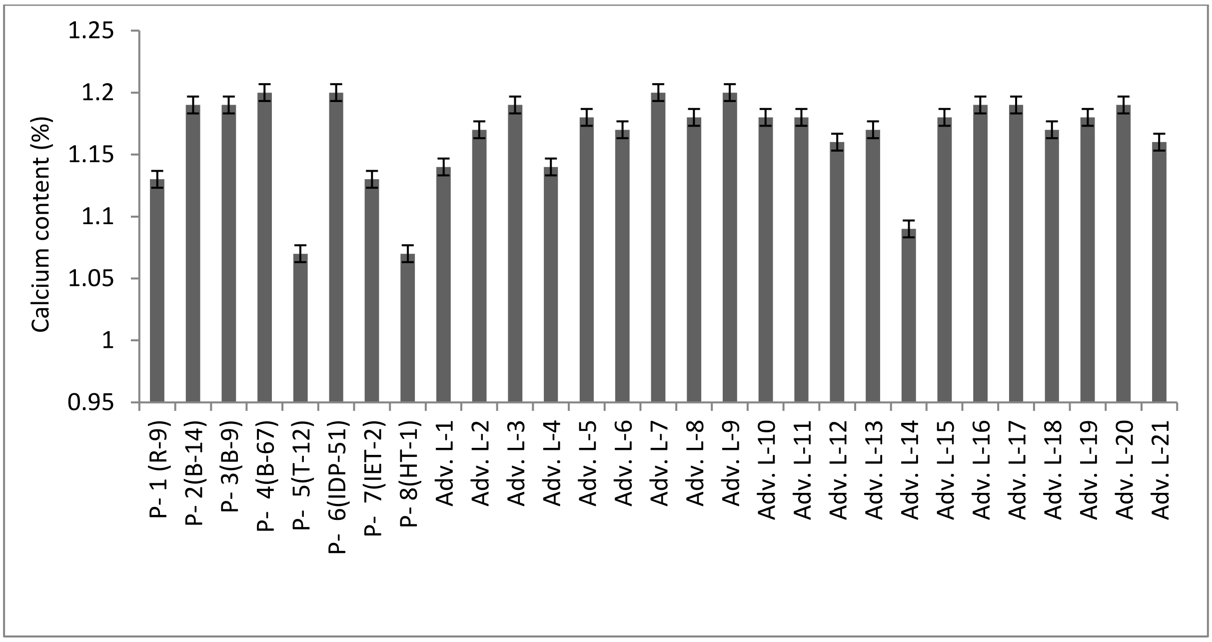

Fig 1. Calcium content in different genotypes [CV (%)-0.751, S.Em- 0.007, CD $_{0.05}$-0.0196, CD $_{0.01}$- 0.0258]

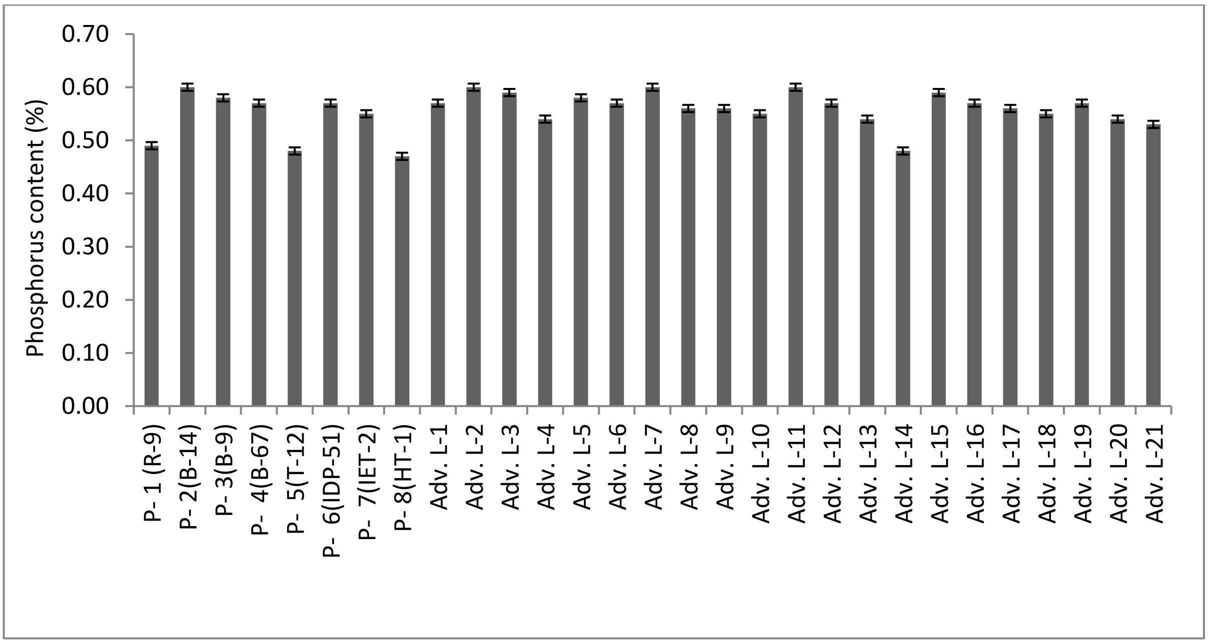

Fig 2. Phosphorus content in different genotypes [CV (%)- 1.25, S.Em- 0.01, CD $_{0.05}$-0.02, CD $_{0.01}$- 0.02]

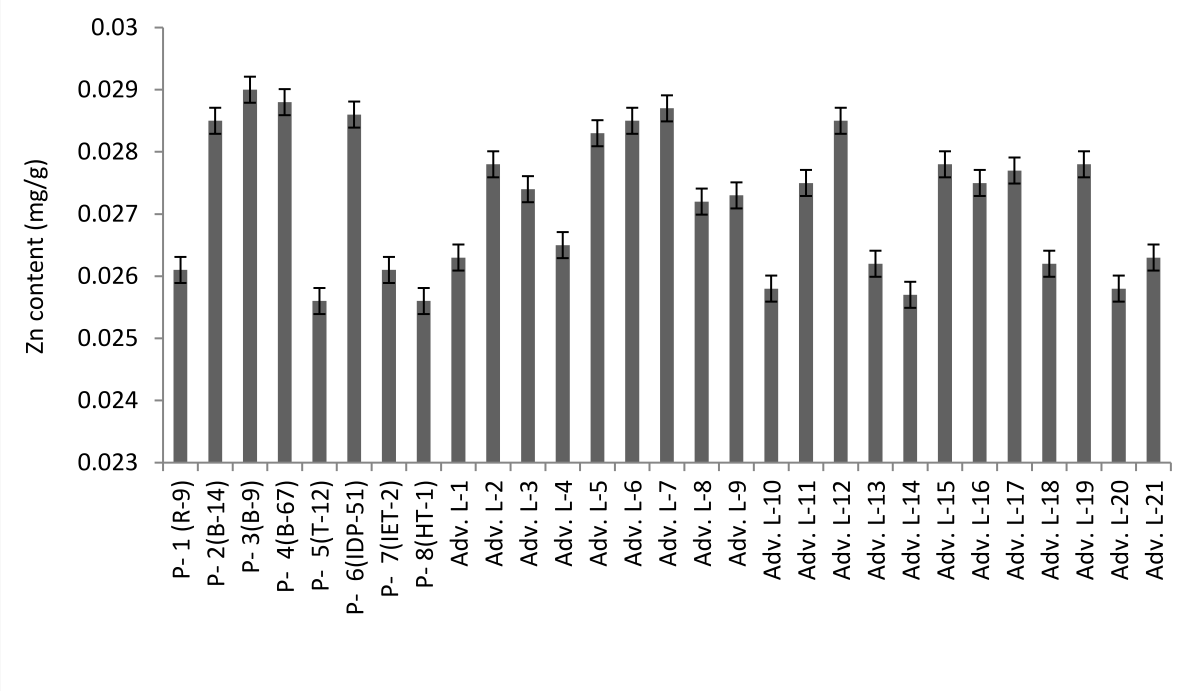

Fig 3. Zinc content in different genotypes [CV (%)- 0.318, S.Em- 0.00007, CD $_{0.05}$-0.00019, CD $_{0.01}$- 0.00025]

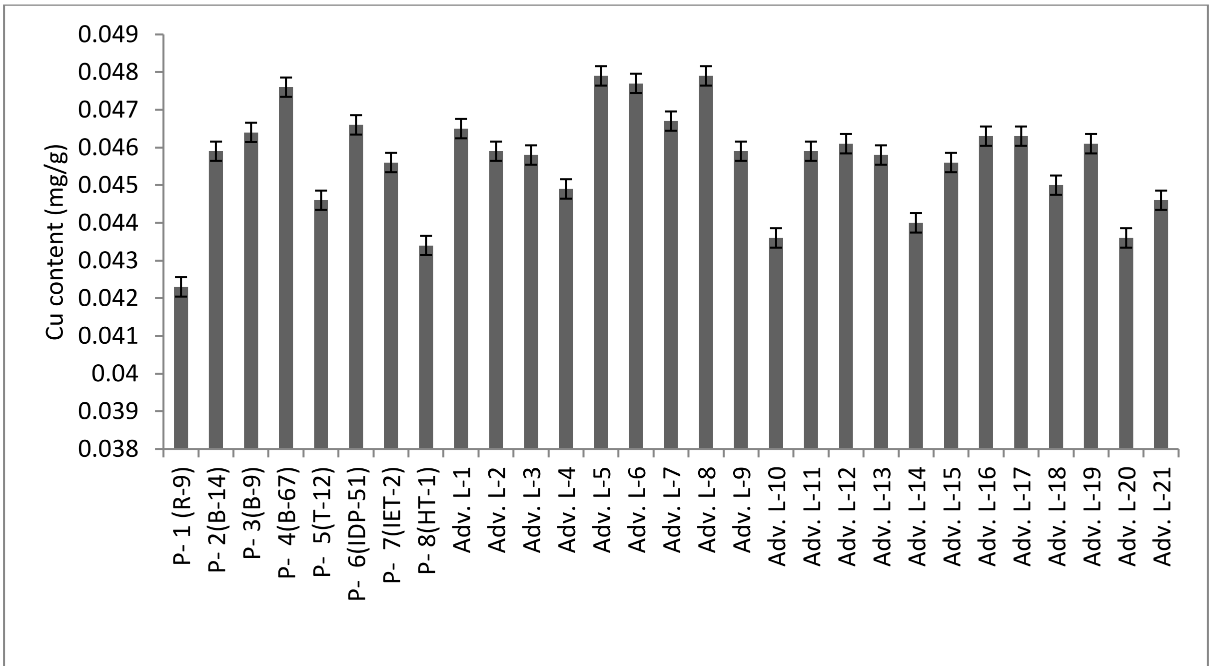

Fig 4. Copper content in different genotypes [CV (%)- 1.054, S.Em- 0.0004, CD $_{0.05}$-0.0011, CD $_{0.01}$- 0.0014]

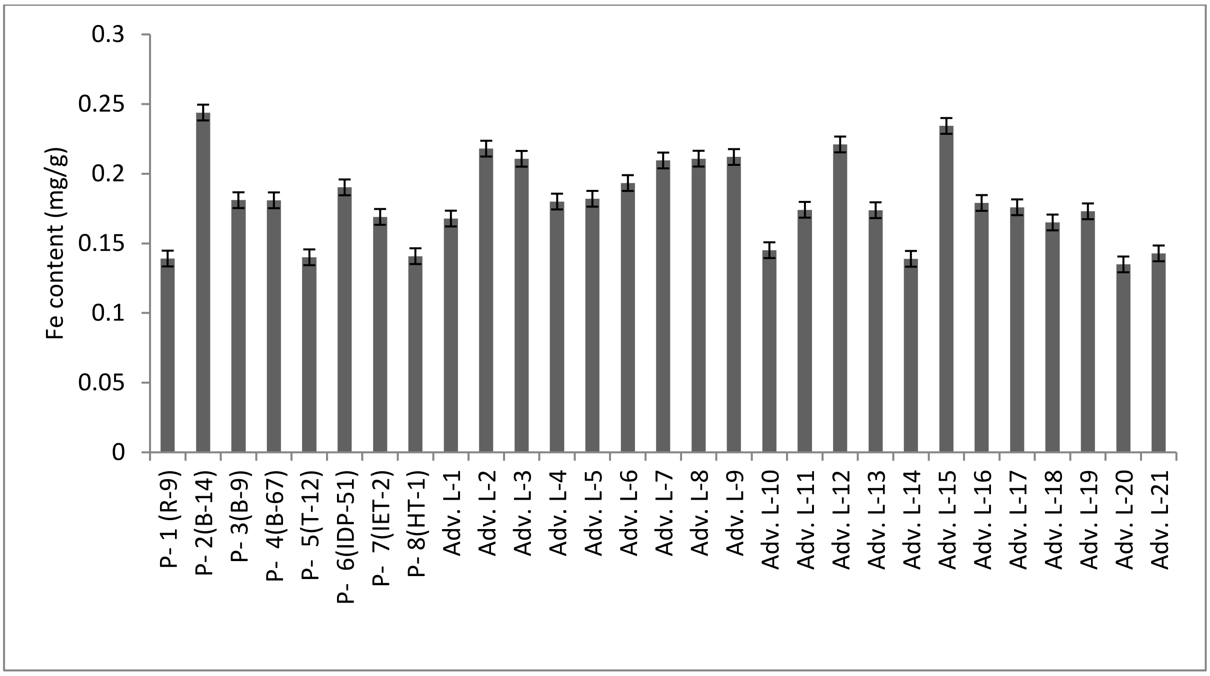

Fig 5. Iron content in different genotypes [CV (%)- 0.1182, S.Em- 0.0002, CD $_{0.05}$-0.0005, CD $_{0.01}$- 0.0007]

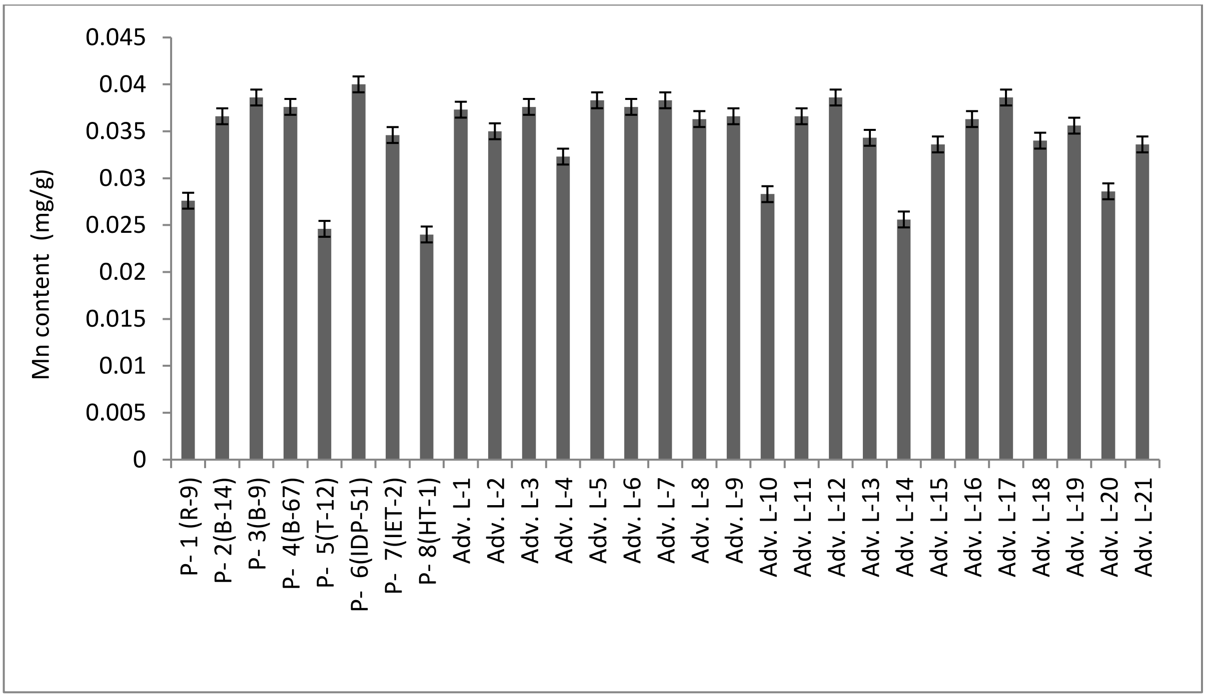

Fig 6. Manganese content in different genotypes [CV (%)- 0.785, S.Em- 0.0299, CD $_{0.05}$- NS, CD $_{0.01}$- NS]

CONCLUSION

Sesame seed is highly nutritive and it has many medicinal values. The observed result supports the usefulness of sesame seeds as a good source of six mineral nutrients: two micronutrients- calcium (Ca) and phosphorous (P) and four micronutrients- manganese (Mn), zinc (Zn), copper (Cu) and iron (Fe). When analysed the mineral constituents, it was found that maximum amount of Ca and P noted in deep coloured seeds. All the parents and advance lines with white/ light coloured seeds contained fewer amounts of all the micronutrients including Mn content in comparison to the genotypes with deep coloured seeds. We can say that analysis of mineral constituents in sesame seed indicates the selection of advance lines would be based on segregants of the crosses involving at least one genotype with deep coloured seeds.

CONFLICT OF INTEREST

The authors have no conflict of interest.

AUTHORS' CONTRIBUTION

BR conducted the whole experiment, hypothesized the paper concept, designed the experiment and collected the data. AKP supported in the experimental works, writing the manuscript and performed statistical analysis.

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