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Research Article

COMPARATIVE STUDIES ON BIOCHEMICAL COMPONENTS IN SESAME (*Sesamum indicum* L.) VARIETIES CULTIVATED IN SUMMER AND *KHARIF* SEASONS

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Abstract- Sesame is one of the oldest and important oil seed crop in the world. The information in comparison to climatic conditions affecting seed biochemical components of sesame was lacking. The present investigation was carried out to compare the biochemical components in three sesame varieties cultivated during kharif and summer seasons. Biochemical constituents *viz*., oil, protein, carbohydrate, fiber, ash, oxalic acid and free fatty acid in sesame varieties were analysed. Oil content in white, black and brown sesame seed in kharif season is 47.85, 45.23 and 45.21% whereas in summer it is 49.63,48.52 and 47.23 having difference of 1.78,3.29 and 2.02%. Result obtained showed that crude protein ranges from 18.52-24.36%, fiber 3.01-3.29%, ash 3.45-3.85%, carbohydrate 14.43-18.52%. All the values obtained are within the range as reported but highest values were find in summer season seed of different colour. The calcium concentration were 1052 μgg^{-1}, 1026 μgg^{-1} and 958 μgg^{-1} in white, black and brown seed of *kharif* season whereas it is highest the free fatty acid and oxalic acid were highest in *kharif* season seed i.e., 1.32,1.43 and 1.58% in summer season i.e., 1167 μgg^{-1}, 1036 μgg^{-1} and 998 μgg^{-1} in white black and brown seeded varieties.

Keywords- Biochemical constituents, *kharif* and summer seasons, sesame and seed composition

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Introduction

Sesame (*Sesamum indicum L.*) is an oilseed with a chemical composition of about 50-52% oil, 17-19% protein and 16-18% carbohydrate [1] chemical composition of about 50-52% oil, 17-19% protein and 16-18% carbohydrate [2]. The hull contains large quantities of oxalic acid, crude fiber, calcium and other minerals. When the seed is properly dehulled, the oxalic acid content is reduced from about 3% to less than 0.25% of the seed weight [3]. Seasame seed contains antioxidant which inhibit the development of rancidity in the oil. In the food industry where synthetic antioxidant are used extensively, there is an increasing demand for more of these natural products [4]. The nutritional benefits derived from sesame seeds are based on the variety being utilized.

Sesame is grown in almost all the states of India in large or small areas. It is grown in different seasons in different parts of the country Sesame plant needs fairly high temperature during its life cycle. Normally the optimum temperature required during its life cycle is 25-30^{0}C. If the temperature is more than 40^{0}C with hot wind the oil content reduced. The crop is very sensitive to excessive water in the field. The well distributed rain during *kharif* season result good crop. During the last decade drastic changes in the climate have been experienced in the country. Aberration in weather condition, irregular and unevenly distributed rainfall have adverse effect on sesame yield. The information in comparison to climatic condition affecting seed biochemical of sesame was lacking.

Therefore, the present investigation was carried out to compare environmental affects on biochemicals component and quality parameter of seed during its development in sesame varieties sown during summer and *kharif* seasons.

Materials and Methods

The present study was consisted with field experimentation and several analytical works in the laboratories. Biochemical components in seed materials of three different sesame varieties TKG-22 (white), GT-10 (Black), and Rama (brown) cultivated during summer and *kharif* season in 2015 were compared. The observation were recorded in freshly harvested seed and the biochemical parameters taken are oil, protein, carbohydrate, fiber, ash, oxalic acid, free fatty acid and mineral content. The present investigation was carried out at biochemistry laboratory, Project coordination unit, AICRP on sesame and niger, JNKVV, Jabalpur (M.P.)

Proximate analysis: Proximate analysis was carried out as described by the association of official analytical chemist [5].

Oil content: Take 2g black and white seed sample were treated with petroleum ether 60-80˚C, volume may be 80 ml. used as a solvent by soxplus apparatus leave the process about 45-60 minutes. After the process time increase the temperature to recovery temperature (Max. boiling point 2). Ex: If the boiling point is 600C recovery temperature can be 120^{0}C. Now do the rinsing about 2 times in order to collect the remaining fat that may present in the sample. Now takeout all the beakers from the system and put them in a hot air oven. After 15 to 20 minutes, take out all the beakers and place them in desiccators for about 5 minutes. Then solvent was evaporated and collect oil.[6]

Oil content (percent) = extracted oil weight (g) X 100 W2 –W1 X 100 /W

FFA percent: 1 ml oil dissolved in 20 ml neutral solution of 95% ethanol then boiled it and titrated with .1 N alkali KOH in the presence of phenolphthalein indicator FFA % calculated using the following formula.

FFA% = 2.303 x Normality of KOH x Titrate value (ml) /Weight of oil sample (g)

Protein: protein percent sample was define by Lowery method.

Oxalic acid: oxalic acid content of the sesame seed was define by titration method as AOCS, 1980

Oxalic acid % = 6.303 X normality of $KMnO_4$ X volume of $KMnO_4$ / Weight of seed sample (gm.)

Minerals: The minerals were determined by atomic absorption spectrophotometry. One gram samples, in triplicate, were dry ashed in a muffle furnace at 550°C for 8 h until a white residue of constant weight was obtained. The minerals were extracted from ash by adding 20.0 ml of 2.5% HCl, heated in a steam bath to reduce the volume to about 7.0 ml, and this was transferred quantitatively to a 50 ml volumetric flask. It was diluted to volume (50 ml) with de-ionized water, stored in clean polyethylene bottles and mineral contents determined using an atomic absorption spectrophotometer (Varien, Model AA240 FS, USA). These bottles and flasks were rinsed in dilute hydrochloric acid (0.10 M HCl) to arrest microbial action, which may affect the concentrations of the anions and cations in the samples. The instrument was calibrated with standard solutions.

The data were statistically analyzed using factorial complete random design and mean values of different parameters were compared using critical difference at 5%.

Result and Discussion

Differences in biochemical constituents *viz.* oil, protein, carbohydrate, fiber, ash, oxalic acid and free fatty acid in sesame varieties grown in summer and *kharif* seasons are reported in [Table-1]. All the three varieties showed higher values for these constituents in summer as compared to kharif season. Oil content in white, black and brown sesame seed in *kharif* season is 47.85,45.23 and 45.21% whereas in summer it is 49.63,48.52 and 47.23 having difference of 1.78,3.29 and 2.02% respectively. Variations in oil contents reflect differences in the environmental factors that influence seed composition. In this respect the considerable difference in precipitation as well as sunshine hours among the years is noteworthy. [7] also demonstrated that increased water availability during capsule development in sesame led to higher oil content. The accessions displayed significant variation amongst them for oil content. However, despite the variation in the precipitation and sunshine hours between the years were identified as having consistent oil content. High and stable oil content is a desirable traits in the breeding of improved sesame cultivars and the above identified accessions are therefore valuable in this respect as reported [8].

Table-1 *Mean values of biochemical components of sesame seeds in different growing seasons*

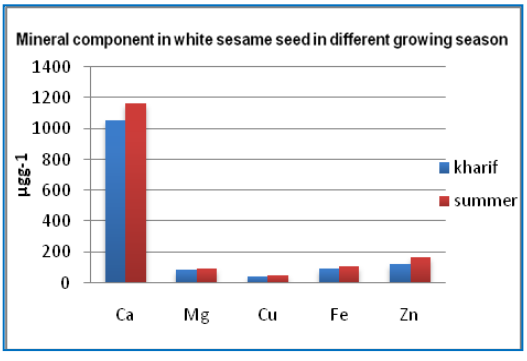
Biochemical parameters	Kharif-2015			Summer-2015		
	White	Black	Brown	White	Black	Brown
Oil (%)	47.85(±1.25)	45.23(±2.60)	45.21(±2.60)	49.63(±0.90)	48.52(±1.23)	47.23(±1.44)
Carbohydrate (%)	16.23(±2.48)	14.43(±1.87)	15.10(±1.34)	17.56(±2.03)	18.52(±1.22)	16.63(±1.18)
Protein (%)	22.36(±2.24)	20.02(±1.49)	18.56(±0.91)	24.36(±1.78)	22.32(±0.98)	22.65(±1.17)
Fiber (%)	3.11(±0.27)	3.29(±0.40)	3.27(±0.40)	3.01(±0.27)	3.26(±0.28)	3.25(±0.26)
Ash (%)	3.47(±0.30)	3.45(±0.25)	3.56(±0.33)	3.67(±0.18)	3.85(±0.20)	3.58(±0.35)
Oxalic acid (%)	1.52(±0.23)	1.58(±0.23)	1.63(±0.15)	1.02(±0.14)	1.32(±0.26)	1.54(±0.31)
Free Fatty Acid (%)	1.32(±0.38)	1.43(±0.32)	1.58(±0.09)	1.12(±0.30)	1.23(±0.29)	1.28(±0.29)

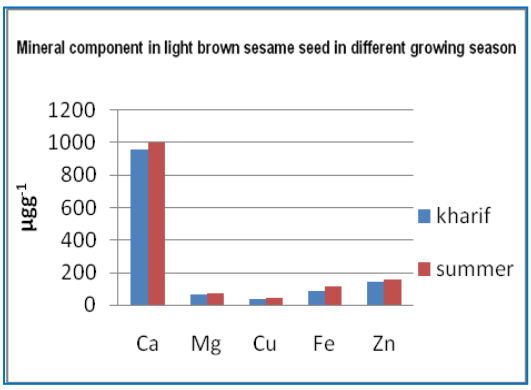
Protein is very important in human nutrition and is one of the nutrients that are frequently low in plant products. Fibre in diet is important as it helps to maintain human health by reducing cholesterol level in the body [9]. High level of ash makes the oilseed a good source of mineral nutrition to the consumer [10]. Result obtained showed that crude protein ranges from 18.52-24.36%, fiber 3.01-3.29%, ash 3.45-3.85%, carbohydrate 14.43-18.52%. All the values obtained are within the range as reported but highest values were find in summer season seed of different colour. But the free fatty acid and oxalic acid were highest in *kharif* season seed i.e 1.32,1.43 and 1.58%. The presence of anti-nutritional factors like oxalic acid and phytic acid (in traces) in the seed coat renders the calcium and phosphorous into non-available form and imparts unpleasant taste also. The oxalic acid binds with calcium to form calcium oxalate, which is not utilized by the human body.. Sesame oil, when used as a cooking medium, produces foam on heating-an undesirable characteristic developed due to the presence of free fatty acids (FFA), which adversely affects the quality and preference of sesame oil as cooking medium. Generally, sesame varieties with high oil content of around 50% in their seed and less than 2.0% FFA in oil are considered as good quality to fetch more prices and demand in the overseas market.

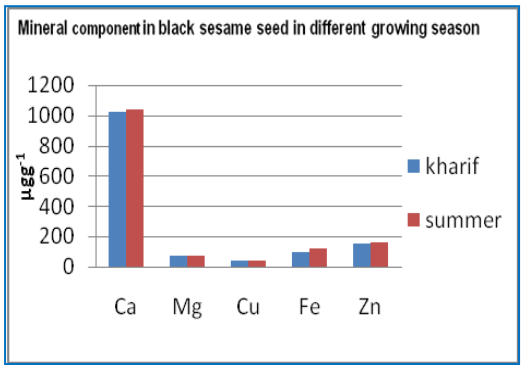
Table-2 *Variation in mineral components of sesame seeds in different growing seasons*

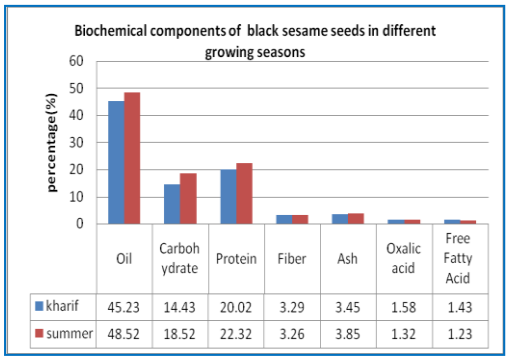
Minerals	Kharif-2015			Summer-2015		
	White	Black	Brown	White	Black	Brown
Calcium(µg g^{-1})	1052	1026	958	1167	1036	998
Magnesium(µg g^{-1})	85	70	66	90	73	70
Copper(µg g^{-1})	43	40	36	51	44	43
Iron(µg g^{-1})	92	96	84	111	121	116
Zinc(µg g^{-1})	120	152	142	170	161	158

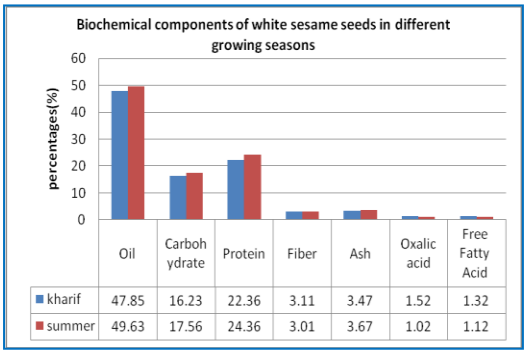
Difference in mineral content *viz*; calcium, magnesium, copper, iron and zinc in the three varieties of sesame in *kharif* and summer season are depicted in [Table-2 and Fig] given. the effected minerals content were low in *kharif* than in summer season. A similar difference within the varieties was also observed. The *Sesamum indicum* L seeds contained significant amount of important minerals. The calcium concentration were 1052 µgg^{-1}, 1026 µgg^{-1} and 958 µgg^{-1} in white, black and brown seed of *kharif* season whereas it is highest in summer season i.e, 1167 µgg^{-1}, 1036 µgg^{-1} and 998 µgg^{-1} in white black and brown seeded varieties. The other minerals concentration like magnesium copper, iron and zinc also showed higher values in summer season seed. Calcium and magnesium plays a significant role in photosynthesis, carbohydrate metabolism, nucleic acids and binding agents of cell walls [11]. Magnesium is essential mineral for enzyme activity, like calcium and chloride; magnesium also plays a role in regulating the acid-alkaline balance in the body.

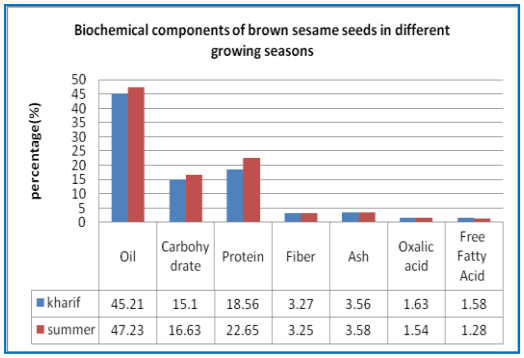












Conclusion: Varieties are seasonally effected from quality point of view, when sown in *kharif* than in summer season, while within the varieties white sesame seed is better in quality too when sown in summer.

Abbreviations: FFA-Free Fatty Acid, HCl-Hydrochloric acid,

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Conflict of Interest: None declared

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