International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(4): 2846-2849

Received: 13-05-2020
Accepted: 15-06-2020

Saurabh Singh Yadav
Department of Agril. Biochemistry, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Ramesh P Singh
Department of Agril. Biochemistry, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

RP Singh
Department of Agril. Biochemistry, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Brijesh Kumar
Department of Agril. Biochemistry, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

RN Kewat
Department of Agril. Biochemistry, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Raj Bahadur
Department of Agril. Biochemistry, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Corresponding Author:
Saurabh Singh Yadav
Department of Agril. Biochemistry, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

Influence of sulphur application on biochemical constituents in Kabuli chickpea (*Cicer kabulium*) varieties

Saurabh Singh Yadav, Ramesh P Singh, RP Singh, Brijesh Kumar, RN Kewat and Raj Bahadur

DOI: https://doi.org/10.22271/chemi.2020.v8.i4ah.10077

Abstract
The present investigation on "Influence of sulphur application on biochemical constituents in Kabuli chickpea (*Cicer kabulium*) varieties." was conducted during *Rabi* season in 2016-17 at the Agronomy research farm and laboratory of Agriculture Biochemistry Narendra Deva University of Agriculture & Technology, Kumarganj Faizabad (UP). was adopted with three replications. Following chickpea varieties were grown with proper agronomic practices and the seeds of ten varieties of chickpea namely NDGK 11-13 (V_1) NDGK 99-9 (V_2) BG 1003 (V_3) JGK1 (V_4) HK 94-134 (V_5) Levels of sulphur 03(S_1, S_2, S_3), S_1=0kg/ha, S_2=20kg/ha, S_3=30kg/ha were undertaken to chickpea varieties with successive were executed in Completely Randomized Design (CRD) was adopted with three replications. Following chickpea varieties were grown with proper agronomic practices and the seeds of ten varieties were collected after harvesting and use for analysis of biochemical Parameters. Viz Carbohydrate content Total mineral content Total sugar, Reducing sugar content .The non-reducing sugar. Protein profiling. The data obtained in the experiment showed the highest total carbohydrate content was found 62.68 percent in variety JGK 1 by the 30 kg/ha sulphur application. total mineral content was found 3.08 (g/100g) in NDGK 99-9 variety by the 0 kg/ha sulphur application. was total sugars (5.72%), reducing sugar (1.80%) non-reducing sugar (3.92%) were observed in variety JGK 1 by the application of 30 kg s/ha and minimum total sugars (4.20%), reducing sugar (1.47%) non-reducing sugar (2.73%) were observed in variety NDGK 11-13 by the application of 0 kg s/ha. The statistical analysis showed that all the chickpea varieties were found significant regarding total sugars, reducing sugar and non-reducing sugar content in the profiling using SDS-PAGE technology is particularly considered as a reliable tool for economic characterization of germplasm.

Keywords: Carbohydrate content total mineral content. total sugar, reducing sugar content, the non-reducing sugar, protein profiling

Introduction
Chickpea (*Cicer arietinum* L.) belongs to the family Leguminaceae is an important winter season pulse crop having extensive geographical distribution. Chickpea is also known as Gram, Bengal gram, Garbanzo bean and sometimes known as Egyptian pea, *ceci*, *ceceorchana*. Chickpea nitrogen fixation plays an important role in maintenance of the soil fertility particularly in the arid and low rainfall areas (Varshney *et al*., 2009) [24]. According to the size, shape and color of the seeds, two types of chickpea are usually acknowledged. Kabuli chickpea is large seeded with salmon white testa, is grown mainly in the Mediterranean area, central Asia and America and Desi chickpea is small seeded with a light brown testa, is cultivated mostly in India and east Africa (Rincon *et al*., 1998) [19].
In India, chickpea is cultivated in an area of 8.35 million/ha with production of 7.17 million tonnes and yield is 960 kg/ha (D.E.S., Ministry of Agriculture, G.O.I. 2015-16). Uttar Pradesh, area of 0.27 (million ha) with production of 0.22 (million tonnes) and yield is 805 (kg/ha), (Agricultural Statistics Division, Directorate of Economics & Statistics, Department of Agriculture & Cooperation, 2015-2016).
Chickpea has one of the highest nutritional composition of any dry edible grain legume and does not contain significant quantities of any specific major antinutritional factors. On an average, chickpea seed contains 23% of highly digestible protein, 64% total carbohydrates, 47% starch, 5% fat (primarily linoleic and oleic acids), 6% crude fibre, 6% soluble sugar and

3% ash. The mineral component is high in phosphorous (343mg/100), calcium (186mg/100g), magnesium (141mg/100g), iron (7mg/100g) and zinc (3 mg/100g) (Williams and Singh, 1987) [25].

Chickpea is good source of protein and carbohydrate. It's protein quality is better than other legumes such as pigeon pea, black gram and green gram (Kaur and Singh, 2005) [13]. A pulse, including chickpea is one of the most important crops of the world due to their nutritional quality. They are rich sources of carbohydrates, protein, vitamins and minerals *(Costa et al.,* 2006 and *Gowen et al*., 2007*)*.

Chickpea contains protein 21%, carbohydrate 61%, fibre 3%, oil 4.8-5.5, calcium 0.2%, phosphorus 0.3%, ash 3%, and 0.12-0.33 mg riboflavin (Atul *et al*., 2011) [3]. Chickpea seed has a high protein digestibility, contains high levels of complex carbohydrates (Low glycaemic index), is rich in vitamins and minerals and is relatively free from anti-nutritional factors (Muzquiz and Wood, 2007; Wood and Grusak, 2007) [17, 26]. The cultivars, growing seasons, soil and climatic conditions and management practices considerably influence protein content. Position of pod also influences the protein content of seeds (Ali *et al.*, 2003) [1].

The total carbohydrate includes mono and oligosaccharides, starch and other polysaccharides. Starch is the most abundant pulse carbohydrate and varies from 31.50 to 53.60 percent (Shad *et al.*, 2009) [23].

Electrophoresis (SDS-PAGE) of seed storage protein can economically be used to assess, genetic variation and relation in germplasm. Thus specific bands of seed storage protein profile may be used as markers for identification of the mutants/genotypes (Hameed *et al.*, 2009) [10].

Chickpea is mostly consumed in the form of processed whole seed or Dal. It is used in preparing varieties of snacks, sweet and condiments. Fresh green seed are also consumed as green vegetables and its leaves consist of malic acid and citric acid which are very useful for stomach problem and it is best blood purifier. It is used for human consumption as well as for feeding to animals. Nitrogen fixation plays an important role in maintenance of the soil fertility, particularly in the arid and low rainfall areas as chickpea being cropped under crop rotation (Roy *et al.*, 2010).

Phytates, oxalates, polyphenols from insoluble complexes with essential dietary components like vitamins, minerals rendering them unavailable to body. Removal of these anti-nutritional factors *via* genetic amendment may be catastrophic since these compounds have alternative beneficial roles in plants. Hence, removal of anti-nutritional factors prior to consumption is a better way of handling the problem. Pulses have shown numerous health benefits, e.g., lower glycemic index for people with Diabetes and Valentine- Gamazo, increased satiation and Cancer prevention as well as protection against cardiovascular diseases due to their dietary fibre content (Chillo *et al*., 2008) [5].

Materials and Methods

The field experiment was conducted at Students Instructional Farm of Narendra Deva University of Agriculture and Technology Kumarganj, Faizabad (U.P.). The biochemical parameters were as Carbohydrate content by the method of Mc Cready *et al*., (1950) [15]. Total sugar, by the method of Dubois *et al.,* (1956) Reducing sugar content by the method of Miller (1959) [16]. Total mineral content in chickpea seeds were estimated with the help of method described by Hart and Fisher (1971) [11]. The non-reducing sugar was obtained by subtraction of reducing sugar from total sugar. Protein profiling using SDS-PAGE technology was done by method given by Laemmli (1970) [14].

Results and Discussion

The ranges of carbohydrate content found between 57.99 to 62.68. Out of fifteen treatments, variety JGK 1 was found superior which gave total carbohydrate 62.68 percent (by 30 kg/ha sulphur application). The result was closely supported by Benu and Srivastav (2006) [4], Shad *et al*., (2009) [23], Salem-Abu *et al.* (2011) [21] and Atul *et al*., (2011) [3], Devi and Saxena (2013) [22] Garg and Sabharwal *et al.,* (2014) [9], Masood *et al*., (2014) [18] who reported that carbohydrate content varied from 56.50 to 63.80 percent. The availability of carbohydrate is important in terms of calorific value (Ali *et al*., 2003) [1].

Out of fifteen treatments, genotype NDGK 99-9 was found superior genotype which gave total mineral content 3.01 percent by 0 kg/ha sulphur application. The result was very much supported by Kaur and Singh (2007) and Saxena and Saxena (2011) who reported variability in total mineral content of chickpea genotypes. The Desi type chickpea contain higher amount of total mineral content in comparison to Kabuli type. This is due to thick seed coat. As the seed coat is the main constituent of minerals (Gaur *et al*., 2010). Shad *et al.*, (2009) [23], Carla and Nobile *et al*., (2013), Abu-salem *et al.,* (2011) [21].

Table 1: Effect of sulphur levels on total carbohydrate content (%) and Total Mineral content (%) in kabuli chickpea seeds.

Symbols	Treatments	Carbohydrate content	Mineral content%
T_1	NDGK 11-13 (S_1)	59.99	2.97
T_2	NDGK 99-9 (S_1)	60.98	3.08
T_3	BG 1003 (S_1)	57.01	2.77
T_4	JGK 1 (S_1)	61.99	2.31
T_5	HK 94-134 (S_1)	61.01	2.51
T_6	NDGK11-13 (S_2)	60.03	2.81
T_7	NDGK 99-9 (S_2)	61.11	2.92
T_8	BG 1003 (S_2)	57.28	2.68
T_9	JGK 1 (S_2)	62.32	2.20
T_{10}	HK 94-134 (S_2)	61.27	2.43
T_{11}	NDGK11-13 (S_3)	60.61	2.59
T_{12}	NDGK 99-9 (S_3)	61.71	2.86
T_{13}	BG 1003 (S_3)	57.61	2.63
T_{14}	JGK 1 (S_3)	62.68	2.10
T_{15}	HK 94-134 (S_3)	61.59	2.39
SEM±		0.44	0.04
CDat 5%		1.26	0.12

The results of Non- reducing sugar content ranged from 2.73-3.92 percent in various varieties of kabuli chickpea. Maximum non- reducing sugar content was found 3.92 percent in JGK 1 by the 30 kg/ha sulphur application. Variety varies significantly among themselves. The variation in non-reducing sugar content was found due to environmental factor. This result was in agreement with Atul *et al*. (2011) [3]. Amir *et al.,* (2006) [2] also reported variations in total sugar content of chickpea genotypes seeds and observed that an increase in the amount of total sugar due to rainfall in comparison to no rainfall.

The results of reducing sugar content have been presented in reducing sugar content ranged from 1.80-1.47 percent in various varieties of kabuli chickpea. Maximum reducing sugar content was observed 1.80 percent in JGK 1 by the 30 kg/ha sulphur application which was significantly superior over the rest of varieties. The germplasm might be due to

genetic character of that germplasm. These results have been favoured by. Atul *et al*., (2011) [3]. The results indicate to close favour with Shad *et al.,* (2009) [23].

Table 2: Effect of sulphur levels on non-reducing, reducing and total sugar content in chickpea

Symbols	Treatments	Non reducing sugar (%)	Reducing (%)	Total sugar (%))
T_1	NDGK 11-13 (S_1)	2.73	1.47	4.20
T_2	NDGK 99-9 (S_1)	3.28	1.63	4.91
T_3	BG 1003 (S_1)	3.00	1.73	4.73
T_4	JGK 1 (S_1)	3.34	1.77	5.11
T_5	HK 94-134 (S_1)	2.83	1.68	4.51
T_6	NDGK 11-13 (S_2)	2.77	1.48	4.25
T_7	NDGK 99-9 (S_2)	3.29	1.70	4.99
T_8	BG 1003 (S_2)	3.08	1.64	4.72
T_9	JGK 1 (S_2)	3.40	1.79	5.19
T_{10}	HK 94-134 (S_2)	2.89	1.68	4.57
T_{11}	NDGK 11-13 (S_3)	2.82	1.48	4.30
T_{12}	NDGK 99-9 (S_3)	3.37	1.73	5.10
T_{13}	BG 1003 (S_3)	3.25	1.65	4.90
T_{14}	JGK 1 (S_3)	3.92	1.80	5.72
T_{15}	HK 94-134 (S_3)	2.99	1.72	4.71
SEM±		0.08	0.06	0.13
CD at 5%		0.25	0.17	0.39

Data in respect of total sugar have been presented in Total sugar content ranged from 4.20-5.72 percent in various varieties of kabuli chickpea. Maximum total sugar content was observed 5.72 percent in JGK 1 which was significantly higher over the rest varieties by the 30 kg/ha sulphur application. It may cause due to environmental factor *i.e.* temperature effect these results are in agreement to Atul *et al.,* (2011) [3], Shad *et al.,* (2009) [23]. These results were supported by Elsheikh *et al.,* (2001) [8].

Protein electrophoresis is a powerful tool for population genetics. As storage proteins are not affected by environmental fluctuation, their profiling using SDS-PAGE technology is particularly considered as a reliable tool for economic characterization of germplasm (Javed *et al.,* 2004). Maximum number of band is of medium molecular weight followed by highest molecular weight bands and low molecular weight bands. Comparison of seed storage proteins have been found to provide no biological basis for separating closely related small and large seeded chickpea (Hameed *et al.,* 2009) [10]. Similar result was recorded in the present study, as no difference in seed storage proteins of bold and small seeded genotypes was observed. Unweighted Pair Group Method with Arithmetic mean (UPGMA) dendogram was based on Sequential Agglomerative Hierarchial Nesred (SHAN) was used for the dendogram profile. Cluster analysis based on SDS-PAGE has proved to be a powerful tool for differentiating Desi type and Kabuli type chickpea genotypes. Low level of inter specific genetic diversity was observed and no clear differentiation was recorded either for agronomic or biochemical characters as various cluster consisted of mixed genotypes from kabuli type.

Similar results were also reported by in present study no clear differentiation was genotypes based on seed storage proteins (Ghafoor. *et al.,* 2002). Seed protein profile is a promising tool for distinguishing cultivars of particular crop species (Hameed *et al.,* 2009) [10]. The SDS-PAGE is considered to be a practical and reliable method for species identification (Ghafoor and Ahmad, 2005). In present study comparative study of bands in chickpea genotypes was used for identification of thirty chickpea genotypes.

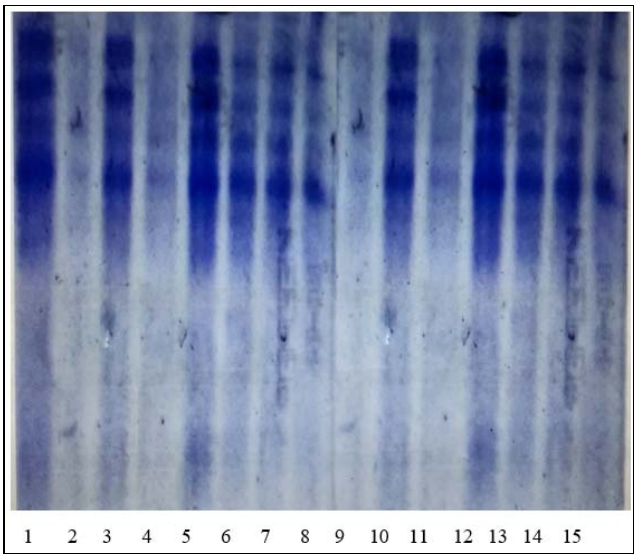

Fig 1: Gel photograph of 15 treatments of kabuli chickpea varieties/strains

Conclusions

On the basis of above observation it may be concluded that maximum carbohydrate (62.86%), mineral content (3.08%) were observed in variety NDGK 99-9 by the 0 kg/ha sulphur application. total sugars (5.72%), reducing sugar (1.80%), and non-reducing sugar (3.92%) were observed in variety JGK 1 (30 kg/ha sulphur application). Maximum days up to 50% flowering (86.50 days).

References

1. Ali MA, Inaotombi L, Sarangthem K, Singh TN. Biochemical changes in germinating seeds of *Cicer arietinum*). Journal of Phytological Research. 2003; 16(2):235-238.
2. Amir Y, Haenni AL, Youyou A. Differences in the biochemical composition of dry legumes cultivated north Algeria electron. J Environ. 2006; 32(2):133-135.
3. Atul P, Singh, Singh RP. Evaluation of biochemical composition of Desi and Kabuli chickpea genotypes. Green farming. 2011; 2(5):516-520.
4. Benu S, Srivastava SK. Nutritive value of new chickpea (*Cicer arietinum* L.) Varieties. Jouranl of Food Agriculture and Environment. 2006; 4(1):48-53.
5. Chillo S, Laverse J, Falcone PM, Protopapa A, Del Nobile. Influence of the addition of buck wheat flour and durum wheat bran on spaghetti quality. Journal of Cereal Science. 2008; 47(2):144-152.
6. Devi R, Saxena AK. Studies on the biochemical, nutritional and processing characteristics of pigeon pea (*Cajanus cajan*. L Millsp) hybrids. Abstract Tirupati. 2013, 7.
7. Dubois M, Giles KA, Hamiltan JK, Rebers PA, Smith F. Calorimetric method for determination of sugar. Anal Chem. 1950; 28:350-356.
8. Elsheikh EAE, Andrews M, Andrews ME, Humphry DR. The effect of inoculation with Rhizobium on the seed chemical and physical properties of legumes. Aspects of Applied Biology. No. 2001; 63:151-163.
9. Garg M, Sabharwal P. Comparative study of field pea, chickpea and their cultivars, Department of Food Technology, University of Delhi, Bhaskaracharya College of Applied Sciences, Dwarka, New Delhi, India.

International Journal of Nutrition and Agriculture Research. 2014; 1(2):83- 92.
10. Hameed A, Shah TM, Atta BM, Iqbal N, Haq MA, Ali H. Comparative seed storage protein profiting of kabuli chickpea genotypes. Pak. J. Bot. 2009; 41(2):703-710.
11. Hart EL, Fisher HJ. Modern food analysis Springer Verlog, New York, 1971, 519.
12. Javed A, Ghafoor A, Anwar R. Seed storage protein electropheresis in ground nut for evaluating genetic diversity. Pak. J Bot. 2004; 36:87-96.
13. Kaur M, Singh N. Studies on functionl thermal and pasting properties of flours from different chickpea *(Cicer arietinum* L) cultivars. Food Chemistry, 2005; 91:403-411.
14. Laemmli EK. cleavage of structural protein during the assembly of the head of bactriophage T4. Nature, 1970; 227:680-685.
15. Cready MC, KE, Muehlbauer FJ. Improving the nutritional value of cool season food legumes. (Quality improvement in field crops) Journal of Crop Production. 1950; 5(1, 2):191-211.
16. Miller GL. Use of dinibo salicylic acid reagent for determination of reducing sugar. Annual Chem. 1959; 31:426-428
17. Muzquiz M, Wood JA. Antinutritional factors. In: Yadav, S. S., Redden, B.; Chen, W.; Sharma, B.; (Eds.), Chickpea Breeding and Management. CAB International, Wallingford, UK, 2007, 143-166.
18. Masood T, Shah H, Zeb A. Effect of sprouting time on proximate composition and ascorbic acid level of Mungbean (*Vigna radiata* L.) and Chickpea (*Cicer arietinum* L.) seeds. The Journal of Animal &Plant Science. 2014; 24(3):850-859.
19. Rincon F, Beatriz M, Ibanez MV. Proximate composition and antinutritive substances in chickpea (*Cicer arietinum* L.) as affected by the biotype factor. Journal of Science of Food and Agriculture. 1998; 78:382-388.
20. Roy A, Ghosh S, Kundagrami S. Genetic approach and biometrical association of yield attributing traits in chickpea (*Cicer arietinum* L.). International Journal of Science and Research. 2016; 5(7):2208-2212
21. Salem, Abu. Properties Physico-chemical of tempeh produced from chickpea seeds. The Journal of American Science. 2011; 7 (7):107-118.
22. Saxena AK, Sharma S, Sandhu JS, Gupta SK, Kaur J. Variability and correlation studies for nutritional and cooking quality traits in chickpea (*Cicer arietinum* L). Indian Journal of Genetics & Plant Breeding. 20l3; 73(l):51-56.
23. Shad AMD, Perrez H, Zafar Z, Haq UL, Z Md, Nawaz H. Evaluation of biochemical composition and physico-chemical parameters of oil from seeds of desi chickpea varieties cultivated in arid zone of Pakistan. Pak. J Bot. 2009; 41(2):655-662.
24. Varshney RK, Hiremath PJ, Lekha P, Kashiwagi J, Balaji J, Deokar AA *et al*. A comprehensive resource of drought and salinity responsiveE. S. Ts. for gene discovery and marker development in chickpea (*Cicer arietinum* L.). BMC Genomics. 2009; 10:523-541.
25. William PC, Singh U. Nutritional quality and the evaluation of quality in breeding programmes pp. 329-356. In the chickpea (Ede McSaxena and K.B. Singh), CAB International/ICARDA, Wallingford, U.K, 1987.
26. Wood JA, Grusak MA. Nutritional Value of Chickpea. In: Yadav, S. S., Redden, B., Chen, W., Sharma, B. (Eds.), Chickpea Breeding and Management. CAB International, Wallingford, UK, 2007, 101-142.