Int.J.Curr.Microbiol.App.Sci (2020) Special Issue-11: 170-177

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-11 pp. 170-177**
Journal homepage: http://www.ijcmas.com

Original Research Article

Physical and Biochemical Studies of Kabuli Chickpea *(Cicer kabulium)* Varieties

Saurabh Singh Yadav*, Ramesh P. Singh, Brijesh Kumar, R.N.Kewat, Shivendra Kumar Vishwakarma and Ram Asheesh

Department of Agril. Biochemistry, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya- 224 229 (U.P.) India

**Corresponding author*

A B S T R A C T

The present investigation on Physical and Biochamical studies of Kabuli chickpea *(Cicer kabulium)* varieties. Effect of sulphur 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 Plant height (cm), Number of pods and root per plant, seeds weight (g),Protein content, Methionine content, Tryptophan content and Lysine content. The data obtained in the experiment showed the highest protein content was found 25.01 percent, methionine content was found 2.16 (g/16gN) in NDGK 11-13 , tryptophan content was found 0.18 g/16N and lysine content was found 7.70 (g/16gN) in NDGK 11-13 by the 30 kg/ha sulphur application.

Keywords

Plant height (cm).Number of pods and root per plant. seeds weight (g). Protein content Methionine content Tryptophan content Lysine content

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*, *cece* or *chana*. 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). 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).

In general, pulse proteins exhibit a wide range of variation in their essential amino acids. Cotyledon, being the major component

of seed accounts for 2.72-0.18 percent of methionine and tryptophan of the whole seed while, the seed coat is usually varies poor in these amino acids. The embryo is rich in methionine and tryptophan, but it contributes only about 2.50 percent of their total quantity in seed. Environmental factors under which the pulse crops are growing influence their amino acid composition (Ali *et al.,* 2003)

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).

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). Chickpea growers of the irrigated as well as arid areas require genotypes with a relatively high yield so that they may compensate their needs. The farmers of the irrigated areas may be able to get not only benefit from restoring nitrogen deficiency in the soil, but also they can get cash return to fulfill their daily requirements after crop harvesting (Khattak *et al*., 2007).

A judicious combination of pulses and cereals in the ration of 1:8 is recommended in the balance diet so that the protein quality of the diet is enhanced. 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). The amino acid composition of pulses has been widely studied. It has been observed that pulse proteins are mainly deficient in sulphur containing amino acids and tryptophan but are rich in lysine in which cereals are relatively deficient. 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).

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).

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 Plant height (cm).Number of pods and root per plant. seeds weight (g). Protein content by the Lowery's method, (1951). Methionine content by the Horn *et al.,* (1946). Tryptophan content by the Spies and Chamber (1949) Lysine content was estimated by the method of Felker *et al.,* (1978).

Results and Discussions

All the fifteen treatments of kabuli chickpea have minor fluctuations but it did not cross the level of significance in respect of days to 50 percent flowering. Out of fifteen treatments, genotype NDGK 99-9 was found superior which gave days to 50 percent flowering 86.50 days by the 0 kg/ha sulphur application. The results indicate to close agreement with Yadav *et al.,* (2001), Singh and Singh (2002), Dhiman *et al.,* (2006) and Bhawani *et al.,* (2008), Tadesses *et al.,* (2016). They reported the variability in days to 50 percent flowering in chickpea genotypes due to genetical characteristics, irrigated condition and time of sowing.

Out of fifteen treatments, variety BG 1003 was found superior which gave plant height 65.70 cm by the 30 kg/ha sulphur application. Among, these genotypes variation in number of pods per plant due to genetical characteristics, time of sowing and irrigated / rainfed condition. The results indicate close correlation with Raina and Kumar (2011), Nawab *et al.,* (2013), Kumar *et al*., (2013) Petrova *et al.,* (2016), Roy *et al.,* (2016) who observed the variability in plant height.

Out of fifteen treatments, variety BG 1003 was found superior which gave number of pods per plant 59.90 by the 30 kg/ha sulphur application. Among, these genotypes variation in number of pods per plant due to genetical characteristics, time of sowing and irrigated / rainfed condition. The results indicate close correlation with Nawab *et al.,* (2013). Kumar *et al*., (2013). Who observed the variability in pods per plant.

Variety JGK 1 appeared to be superior which gave highest 100 seeds weight 34.70 by the 30 kg/ha sulphur application. Among these genotypes variation in 100 seeds weight, due to genetical characteristics, time of sowing and irrigated/ rainfed condition. The result was favourable agreement with Thagna *et al.,* (2009), Munirathnam and Sangita (2009), Saxena *et al*., (2013), Parhe *et al.,* (2014) who reported that 100 seed weight in 24 chickpea genotypes varied from 21.79 to 37.85 g.

The number of root nodules was found in increasing pattern up to 60 day followed by decrease at 90 days. The data pertaining to the number of root nodules at 30, 60 and 90 days in leaves of chickpea varieties was found in the range of 33.20-39.40, 36.90-44.10 and 34.90-41.90 The findings found that genotype NDGK 11-13 appeared to be superior which gives maximum number of root nodules in 30 days (39.40), 60 days (44.10) and 90 days (41.90) by 30 kg/ha sulphur application.

Among, these genotypes variation in number of root nodules per plant due to genetical characteristics, dose of fertilizer and irrigated / rainfed condition. The results indicate close correlation with Singh, *et al.,* (2018).

Protein content varied from 21.01 to 25.01 percent in various varieties of kabuli chickpea. Maximum protein content was found 25.01 percent in NDGK 11-13 (30 kg/ha sulphur application) which was statistically significant superior over the rest of varieties. These results are in close with Shad *et al.,* (2009), Salem and Arab (2011), Atul *et al.,* (2011), Carla and Nobile *et al*., (2013), Devi and Saxena (2013), Sharma *et at.,* (2013), Masood *et al*., (2014), Ghribi *et al*., (2015).

Data pertaining to tryptophan content have been shown in Table 3. The data showed that Tryptophan content (g/16gN) varied from 0.18-0.11 (g/16gN) in various varieties of kabuli chickpea. The maximum tryptophan content was found 0.18 g/16N in NDGK 11-13 by the 30 kg/ha sulphur application.

Varieties vary significantly among themselves. The variation of tryptophan content was found due to nitrogen in plant. Since nitrogen is a structural component of any amino acid, therefore it may lead to increase in the synthesis of tryptophan. Thus higher the protein content, higher will be amount of tryptophan. These results are in support by Yadav and Srivastava (2002). Similar results were obtained by Kushwaha and Srivastava (1978) in Chickpea (Table 1–3).

Table.1 Effect of sulphur levels on days to 50 percent flowering plant height (cm) Number of pods per plant and 100 seeds weight (g) in kabuli chickpea genotypes

Symbols	**Treatments**	**Days to 50% flowering**	**Plant height(cm)**	**Number of pods per plant**	**100 seeds weight (g)**
T_1	NDGK 11-13 (S_1)	85.80	63.50	51.50	24.10
T_2	NDGK 99-9 (S_1)	86.50	63.90	50.20	24.00
T_3	BG 1003 (S_1)	85.60	64.00	52.50	24.30
T_4	JGK 1 (S_1)	66.00	46.60	40.10	32.70
T_5	HK 94-134 (S_1)	76.47	61.50	48.20	28.10
T_6	NDGK11-13 (S_2)	84.00	64.20	53.60	24.50
T_7	NDGK 99-9 (S_2)	84.97	64.00	54.50	25.00
T_8	BG 1003 (S_2)	85.00	64.50	53.80	24.83
T_9	JGK 1 (S_2)	65.33	46.90	43.50	33.50
T_{10}	HK 94-134 (S_2)	75.50	62.20	51.30	28.50
T_{11}	NDGK11-13 (S_3)	83.50	65.40	56.50	25.50
T_{12}	NDGK 99-9 (S_3)	83.80	64.90	55.50	25.60
T_{13}	BG 1003 (S_3)	84.00	65.70	57.90	25.50
T_{14}	JGK 1 (S_3)	64.00	47.50	55.20	34.70
T_{15}	HK 94-134 (S_3)	75.00	63.10	46.50	29.67
SEM±		**0.44**	**0.55**	**1.47**	**0.75**
CD at 5%		**1.26**	**1.58**	**4.27**	**2.17**

Table.2 Effect of sulphur levels on number of root nodules at 30, 60 and 90 day after germination

Symbols	Treatments	Root nodules		
		30 days	**60 days**	**90 days**
T_1	NDGK 11-13 (S_1)	35.50	39.00	37.10
T_2	NDGK 99-9 (S_1)	34.80	38.10	36.60
T_3	BG 1003 (S_1)	34.50	37.80	35.10
T_4	JGK 1 (S_1)	33.20	36.90	34.90
T_5	HK 94-134 (S_1)	34.10	37.70	35.80
T_6	NDGK 11-13 (S_2)	36.80	42.10	40.20
T_7	NDGK 99-9 (S_2)	36.30	41.70	38.10
T_8	BG 1003 (S_2)	36.90	40.00	38.20
T_9	JGK 1 (S_2)	36.80	39.50	37.00
T_{10}	HK 94-134 (S_2)	35.70	39.70	37.50
T_{11}	NDGK 11-13 (S_3)	39.40	44.10	41.90
T_{12}	NDGK 99-9 (S_3)	38.91	43.50	41.30
T_{13}	BG 1003 (S_3)	38.90	42.20	40.10
T_{14}	JGK 1 (S_3)	37.90	41.10	39.20
T_{15}	HK 94-134 (S_3)	36.80	41.50	38.90
SEM±		**0.60**	**0.65**	**0.59**
CD at 5%		**1.75**	**1.89**	**1.72**

Table.3 Effect of sulphur levels on protein content, total methionine content, tryptophan content and lysine content (g/16gN)

Symbols	Treatments	Protein content	Methionine content (g/16gN)	Tryptophan content (g/16gN)	Lysine (g/16gN)
T_1	NDGK 11-13 (S_1)	24.07	2.13	0.17	7.66
T_2	NDGK 99-9 (S_1)	21.01	1.90	0.11	7.01
T_3	BG 1003 (S_1)	23.25	2.08	0.15	7.49
T_4	JGK 1 (S_1)	22.81	2.07	0.14	7.45
T_5	HK 94-134 (S_1)	22.50	1.99	0.12	7.24
T_6	NDGK11-13 (S_2)	24.29	2.15	0.17	7.68
T_7	NDGK 99-9 (S_2)	21.56	1.91	0.12	7.03
T_8	BG 1003 (S_2)	23.91	2.09	0.16	7.57
T_9	JGK 1 (S_2)	23.01	2.08	0.14	7.49
T_{10}	HK 94-134 (S_2)	22.94	2.01	0.13	7.28
T_{11}	NDGK11-13 (S_3)	25.01	2.16	0.18	7.70
T_{12}	NDGK 99-9 (S_3)	21.98	1.93	0.13	7.04
T_{13}	BG 1003 (S_3)	24.01	2.09	0.17	7.64
T_{14}	JGK 1 (S_3)	23.65	2.07	0.15	7.51
T_{15}	HK 94-134 (S_3)	23.02	2.01	0.13	7.31
SEM±		**0.23**	**0.02**	**0.01**	**0.05**
CDat 5%		**0.66**	**0.07**	**0.02**	**0.15**

The data regarding to methionine content (g/16gN) was shown in Table 3. The data showed that methionine content varied from 1.90-2.16 (g/16gN) in various varieties of kabuli chickpea. Maximum methionine content was found 2.16 (g/16gN) in NDGK 11-13 by the 30 kg/ha sulphur application. Varieties vary significantly among themselves. The variation of methionine varied due to transmethylation reaction which leads to formation of different amino acid. A similar observation was also recorded by Yadav and Srivastava (2002), Popli *et al.*, (1982), Katiyar *et al*., (2016).

Lysine is an essential amino acid having a

positive charged α– amino group and basic in nature. Lysine is basically an alanine with a prolamine substituents on the β-carbon. The alpha-amino group has significantly higher key role than the amino group. The lysine content was recorded in the range of 7.01-7.70 (g/16gN). Maximum lysine content was found 7.70 (g/16gN) in NDGK 11-13 by the 30 kg/ha sulphur application. A similar observation was also recorded by Saleh *et. al*., (2006). Variation in lysine content may be due to difference in genetic potential and protein content of chickpea varieties.

In conclusions, on the basis of above observation it may be concluded that maximum number of pods per plant (57.9) and plant height (65.7cm) were recorded in variety BG 1003 by the 30 kg/ha sulphur application. Maximum number of root nodules observed in increasing pattern up to 60 days followed by decrease at 90 days, protein (25.01%), methionine (2.16 g/16gN), tryptophan (0.18 g/16gN) and lysine (7.70 g/16gN) were recorded in variety NDGK 11-13 (30 kg/ha sulphur application). Highest 100 seed weight (34.7gm),. Maximum days up to 50% flowering (86.50 days) and mineral content (3.08%) were observed in variety NDGK 99-9 by the 0 kg/ha sulphur application.

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