J. Cotton Res. Dev. **29** (1) 87-89 (January, 2015)

Nutritional quality constituents' relationship in *desi* (*Gossypium arboreum*) cotton

S. MANDHANIA*, S. R. PUNDIR, S.S. SIWACH, R. S. SANGWAN, O. SANGWAN, S. NIMBAL AND ASHISH JAIN

Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar-125004

**Email: smbiochem@gmail.com*

ABSTRACT : The present study was taken up to study the relationship of nutritional and anti nutritional components of *Gossypium arboreum* seed. Seeds of *G.* 17 *arboreum* genotypes were received from AICCIP trial, Cotton Research Station, CCS Haryana Agricultural University, Hisar. The samples were ground to powder and processed for the estimation of nutritional parameters such as protein, oil, sugar and gossypol content. The data was correlated to find the inter relationship between these constituents. The results showed that oil content exhibited a significant positive correlation with sugar and gossypol, an anti nutrient factor. Protein showed non significant positive correlation with sugar and oil content. An inverse non significant correlation was found between protein and gossypol. This study indicated that inter relationship between different seed quality attributes leads to path for further cotton improvement strategies.

Key words : *G. arboreum*, correlation coefficient, cotton, gossypol, oil

Cotton or White 'Gold' is the principal fibre crop of the world. It plays an important role in Indian agriculture, industrial development and contribution to the national economy. India has the target area of 115.83 lakh ha with the production of 375 lakh bales of 170 kg (Anonymous, 2013). In addition to 21 per cent oil, cotton seed is a source of relatively high quality protein (23%). However, the ability to use this nutrient rich resource of food is hampered by the presence of toxic gossypol that is unique to the fibre gossypieae. This cardio and hepatoxic terpenoid, present in the gossypol glands, renders cotton seed unsafe for human monogastric animal consumption (Risco and Chase, 1997). Gossypol and related terpenoids are present throughout the cotton plant in the glands of foliage, floral organs, and bolls as well as in the roots. These compounds protect the plants from both insects and pathogens. After the discovery of a glandless mutant, several breeding programmes were launched in U.S. Africa and Asia to transfer the glandless trait into commercial varieties to produce gossypol free cotton seed. However, these glandless varieties were a commercial failure due to more attack by insect pest.

Many factors contribute to variation in the nutrient and gossypol content of cotton seed. Besides being the good source of protein and oil, it was not a good source of feed and food. However, these nutritional components are inter related and a variation in one may adversely affect the other like high protein cotton seed may have lower gossypol content. Thus keeping in mind the importance of nutritional composition of cotton seed, the present study was designed to investigate the inter relationship between nutritional and anti nutritional quality component of *G. arboreum* genotypes. The outcomes of study will immensely help the cotton breeders in designing breeding strategies for developing nutritionally improved cotton genotypes.

Seeds of 15 *G. arboreum* genotypes received from AICCIP trials, conducted during 2012-2013 at Cotton Research Area, Cotton Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar, were used for this study. The seed samples were oven dried to reduce the moisture level to meet the accuracy of the results. About 10 g whole cotton seed were ground to powder by using course grinding and then defatted for

protein, sugar and gossypol analysis. The dried defatted samples were fine grind and finally kept in desiccators for analysis of various nutritional quality parameters.

Protein content was determined by Microkejdahl method of AOAC (1970). In this method the defatted samples were digested until solution becomes colorless. Further distillation and titration was done by using 40 per cent NaoH and 0.1N HCl, respectively. The oil content was estimated by the method of AOAC (1970) using solvent extractor system. In this method, extraction of oil was done using non polar solvent petroleum benzene (40-60°C). The sugar content was estimated by colorimetrically by recording optical density at 490 nm and then calculated its concentration by using glucose standard curve. The gossypol an anti nutrient component in cotton seed was estimated by using phloroglucinol reagent. The samples were taken in technical triplicate repeats for the respective constituents' analysis. The data was statistically analyzed by CRD design and Pearson correlation coefficient among different quality components was determined.

The proximate composition of seed of different varieties of *G. arboretum* is presented in Table 1. Average crude protein content of seeds of cotton was 23.413 per cent. Crude protein content was highest in IMDH 22 genotype. Most of the genotypes were contain significantly lower protein content expect genotypes CISAA2, FMDH 25, NACH 41 and FMDH 40. Zakirov *et al.*, (1982) showed variation in crude protein content of cotton seed. Higher protein content was reported in the Nigerian commercial cotton seeds and Zhemian variety. The variation may be attributed to variety and location. The average crude oil content of seeds of different *G. arboreum* was 19.832 per cent, whereas, highest (21.485 %) crude oil was observed in CISAA 2 genotype and *at par* with genotypes FMDH 40 and AKDH 96. The variation in crude oil content of G. *arboreum* seeds have been attributed to environmental conditions in addition to that of varieties. Gossypol an anti nutritional constituent found in all plants part, useful for plant to protect from insect pest, whereas in seed it is harmful for mammal and animals. Genotype FMDH 25 was found to contain lowest (0.405 %)

Table 1. Nutritional profile of *desi* cotton genotypes on dry weight basis

Sr. No.	Genotypes	Protein (%)	Oil (%)	Sugar (%)	Gossypol (%)
1	AAH 32	20.034	19.935	2.011	0.593
2	AAH 33	20.962	19.575	1.976	0.501
3	AAH 34	23.113	18.935	1.980	0.533
4	AKDH 96	23.188	20.495*	2.094	0.452
5	AKDH 97	23.855	20.175	2.155*	0.530
6	CISAA 2	25.043*	21.485	2.274*	0.561
7	CISAA 22	23.225	20.415	2.220	0.589
8	FMDH 15	23.373	19.755	2.186*	0.581
9	FMDH 22	25.896	20.350	2.052	0.537
10	FMDH 23	23.262	20.170	2.152*	0.514
11	FMDH 25	24.820*	18.740	1.908	0.405
12	FMDH 40	24.709*	21.015*	2.278	0.564
13	Mahabeej DH 904	21.741	16.325	1.949	0.427**
14	NACH 41	24.709*	21.030	2.236*	0.529
15	RAJDH 444	23.262	19.075	2.007	0.464
	Mean	**23.413**	**19.832**	**2.099**	**0.520**
	C.D. (p=0.05)	1.835	1.007	0.179	0.033
	SE(m)	0.603	0.331	0.059	0.011
	SE(d)	0.853	0.468	0.083	0.015
	C.V. (%)	3.643	2.36	3.962	2.955

*The values are at with highest value in their respective constituents
**The value is at par with lowest value in gossypol constituent

gossypol content and all the genotypes differs significantly except Mahabeej DH 904 genotype, which was differs non significantly. Similar level of gossypol content in cotton seed was reported but low (0.08 %) gossypol content in cotton seed was observed by Renuka *et al.*, (2005). The Sugar content ranged from 1.908 to 2.274 per cent in FMDH 25 and CISAA 2, respectively, whereas, the genotypes CISAA2, NACH 41, FMDH 15, AKDH 97 and FMDH 23 were contain non significantly lower sugar content as compared to CISAA 2 genotype. Highest variability was observed for oil and gossypol content genotypes whereas lowest variability was observed for sugar content. Amongst all genotypes FMDH 25 was found to be superior in terms of higher protein content and lowest gossypol content.

Correlation coefficients among various components such as protein, oil, sugar and gossypol are given in Table 2. Protein content exhibited non significant positive correlation with sugar and oil content, whereas an inverse non significant negative correlation was observed with gossypol content. Significantly positive correlation was established between oil, sugar and gossypol content. The varieties had highest oil content had highest gossypol content, whereas, negative correlation between nitrogen and gossypol content in kernal of cotton. Our results are also supported with result of several scientists who reported positive correlation between oil and gossypol content. An important finding of the present study is the significant positive correlation observed between oil, sugar and gossypol content and positive correlation between these components implies that breeding for any one component could be strategized simultaneously for all components. Finally, we can say that nutritional and anti nutritional components in cotton seed are logically inter related and an alternation in one may affect the other. The outcome of this study can be used by researcher to develop an approach for further breeding strategies to improve nutritional cotton seed quality.

Table 2. Correlation coefficient among different quality constituents in desi cotton genotypes

	Protein	Oil	Sugar	Gossypol
Protein	1	0.432^{NS}	0.437^{NS}	-0.015^{NS}
Oil	0.432^{NS}	1	0.770**	0.612*
Sugar	0.437^{NS}	0.770**	1	0.639*
Gossypol	-0.015^{NS}	0.612*	0.639*	1

NS : Non Significant, *Significantly correlated
**Highly significantly correlated

REFERENCES

Anonymous, 2013. *"Annual Report"* AICCIP 2013-2014. CICR, Nagpur

AOAC 1970. Official methods of analysis. Association of Official Analytical chemicals, edn Washignton DC. pp.744-5

Dubois, M. K., Gilles, A., Rebers, J. K. P. A. and Smith, F. 1956. Colorimetric Method for Determination of Sugars and Related Substances. *Anal. Chem.* **28** : 350-56.

Renuka, C. K., Kumarmath, P. S., Kadakol, J. C. and Hosamani, S.V. 2005. Chemical composition and anti nutritional factors in different parts and whole cotton (*G. hirsutum*) plant, *Karnataka J. Agric. Sci.* **18** : 114-17.

Risco, CA. and Chase, C.C. J. 1997. In *Handbook of Plant and Fungal Toxicants*, ed D'Mello JPF (CRC Press, Boca Raton, FL), pp 87–98.

Zakirov, A., Nutritdinov, A.N. and Kiktev, M. M. 1982. Biochemical characaateristics of new cotton varieties in the collection. *USSR Fanlar Akad. Dokl.* **5** : 57-58

Recieved for publication : September 20, 2014
Accepted for publication : December 10, 2014