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BIOCHEMICAL CONSTITUENTS AND FATTY ACID PROFILING OF DIFFERENT COTTON GENOTYPES

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Abstract: Cottonseed oil (*Gossypium hirsutum* L.) has long been considered to be a good vegetable oil for frying, in part because it tends to impart a toasted aroma to fried products. Considerable background information is needed to study the degree of compositional variation that exists in the seed oil, fatty acid profiling, gossypol and protein content of cotton genotypes. The seeds of thirty eight genotypes were analyzed for oil, gossypol and protein content. The results showed significant variations amongst the genotypes. Significantly higher oil content was observed in PBH 21(17.18%) followed by CCH 15-2(17.07%), SHM-55(17.01%), RAH 1069(17.01%). Gossypol content ranges from 36.46 to 171.70 mg % in different entries. Highest protein content was observed in CNH-126(25.34%). Fatty acid profiling of top four oil content entry viz. PBH-21, CCH-15-2, SHM-55 and RAH 1069 were carried out. The saturated, unsaturated fatty acid content and area were differed in different genotypes.
Keywords: Cotton, Gossypol, Oil, Fatty acid profile.

Introduction

Cottonseed oil (*Gossypium hirsutum* L.) has long been considered to be a good vegetable oil for frying, in part because it tends to impart a toasted aroma to fried products. Cottonseed oil also has disadvantages that have resulted in some food companies limiting their use of the oil. Specifically, the oxidative stability of cottonseed oil can be lower than other vegetable oils because of its high concentration of linoleic acid (18:2). When used for frying, this instability accelerates the formation of off-flavors (rancidity) and shortens oil life. Although the level of these acids is significantly reduced by oil deodorization, they would be fully present in whole seed or kernel feeding of cottonseed to animals, a practice that would increase if current efforts to reduce seed gossypol levels prove successful [1]. Protein content and Fatty acid profile of cottonseed oil were varies from genotypes to genotypes. However, considerable background information is needed to study the degree of compositional variation that exists in the seed oil, fatty acid profiling, gossypol and protein content of cotton genotypes.

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Materials and Methods

Oil Analysis: Cotton seed of 38 genotypes were collected from Indo American section of Main Cotton Research Station, NAU, Surat. Seeds of 38 cotton genotypes were crushed to make a powder for Oil analysis by Near Infra Red spectroscopy (Table 1).

Protein analysis: Protein was estimated from cotton seed by standard methods of Folin [2].

Gossypol estimation: Protein was estimated from cotton seed by standard methods [3].

Fatty acid Profiling by GCMS

Oil extraction: Extraction of oil from seed was carried out by standard methods of AOAC Official method No. 969.33 [4]. About 2 g of the seeds were ground in a ball mill and extracted with petroleum ether in a soxtherm apparatus for 6 h. The solvent was removed by a rotary evaporator at 40 °C and 25 Torr. The oil was dried by a stream of nitrogen and stored at −20 °C until use.

Fatty acid composition analysis: The profiling of fatty acid from oil was done by GCMS. Fatty acid methyl esters were prepared by methylation of the lipids [5]. Gas chromatography of the methyl esters was conducted on a shimadzu equipped with a hydrogen flame ionization detector. The carrier gas was nitrogen at a flow rate of 30 ml/min. A glass column, of 200 x 0.5 cm o.d., packed with DEGS 10% on 80-100 mesh Chromosorb was used for fatty acid analysis. The column Temperature was 180°C. The peak area was integrated using a Hewlett-Packard PC integrator.

Results and Discussion

The seeds of thirty eight genotypes were analyzed for oil, gossypol and protein content. The results (Table 2) showed significant variations amongst the genotypes. Significantly higher oil content was observed in PBH 21(17.18%) followed by CCH 15-2(17.07%), SHM-55(17.01%), RAH 1069(17.01%). Gossypol content ranges from 36.46 to 171.70 mg % in different entries. Lowest gossypol content was observed in RAH 1069(36.46 mg %) followed by ARBH-1501(39.81 mg %), TSH 321(44.71 mg %) and CNH 147-1(45.76 mg %). Free gossypol content across Bt varieties ranged from 115-414 mg% while it reported to be ranging from 199-414 mg [6]. Processing of cottonseed was reduced the gossypol content. Highest protein content was observed in CNH 126(25.34%) which was followed by RB-602(22.85%) and Local Check (G.Cot-20) (22.7%). Our results of Cotton seed oil, Protein and gossypol were revealed the similarity with the early year report [7].

Fatty acid profiling of top four cotton seed oil content entry viz. PBH-21, CCH-15-2, SHM-55 and RAH 1069 were carried out. Table 3 showed the saturated and unsaturated fatty acid

content (relative). Genotype ARBH-1501 showed highest saturated fatty acid (29.05%) while unsaturated fatty acid was found higher in SHM-55 (73.36%) followed by PBH-21. Fig-1 showed the area % covered by different fatty acids in different genotypes. The concentration of palmitic acid (16:0), a saturated fatty acid, is higher in cottonseed oil (~24%) than in many other vegetable oils. Although higher levels of saturated fatty acids contribute functionality in food systems, they also contribute negatively to serum cholesterol profiles [8]. Fatty acid profile revealed that FA7: 9,12-Octadecadienoic acid (Z,Z)-, methyl ester was covered maximum area in all the genotypes followed by FA2: Hexadecanoic acid, methyl ester and FA5: 9-Octadecenoic acid (Z)-, methyl ester. Fatty acid FA.9: Eicosanoic acid, methyl ester covered lowest area in all the genotypes.

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Table 1: List of genotype used for biochemical analysis

1	ARBH-1501	20	GJHV-517
2	TSH 321	21	H 1478
3	CSH 2932	22	RS 2815
4	GSHV-173	23	Suraj
5	CNH 147-1	24	RAH 1271
6	RAH 1069	25	CPD-1502
7	G.Cot-20	26	TCH 1716
8	F 2522	27	CCH 15-1
9	ARBH-1502	28	HS 296
10	HS 295	29	GSHV-172
11	PBH 29	30	TSH 322
12	RB-602	31	PBH 21
13	CPD-1501	32	BGDS 1033
14	CNHO 12	33	GJHV-519
15	SHM-55	34	RS 2797
16	CSH 2920	35	TCH 1824
17	BGDS 1055	36	L – 799
18	F 2532	37	RB-601
19	CNH 126	38	CCH 15-2

Table 2: Evaluation of cotton genotypes for seed oil, gossypol and protein

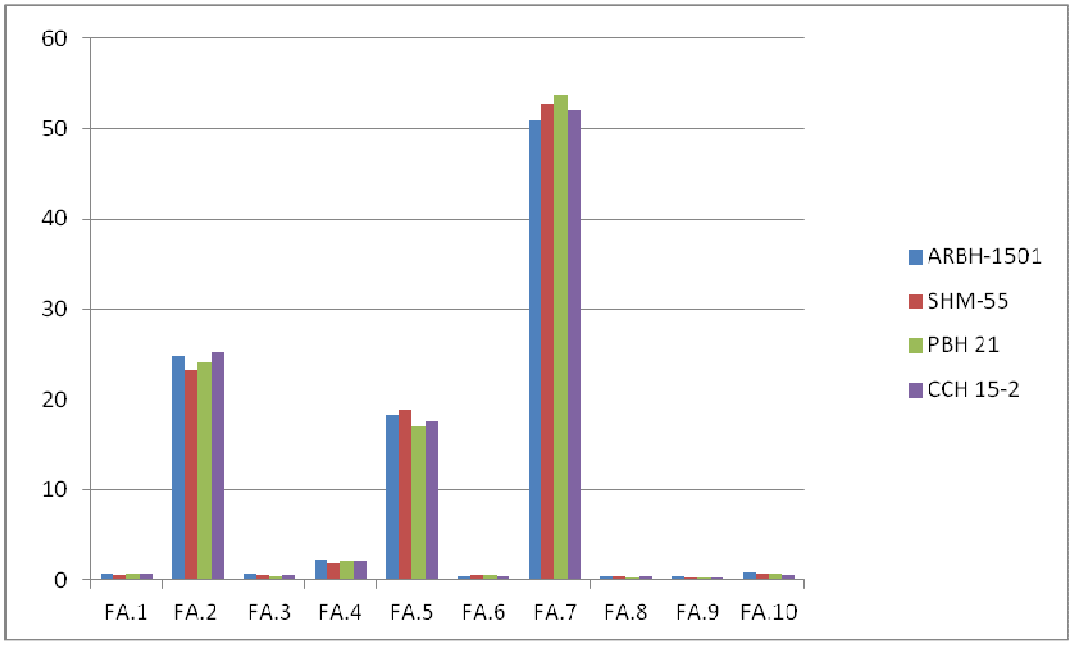
Sr. No.	Code No.	Oil content (%)	Protein (%)	Gossypol (mg %)
1	ARBH-1501	17.00	20.35	39.81
2	TSH 321	15.67	16.48	44.71
3	CSH 2932	16.96	15.46	100.93
4	GSHV-173	16.59	17.75	72.43
5	CNH 147-1	16.53	15.38	45.76
6	RAH 1069	17.01	15.03	36.46
7	G.Cot-20	16.62	22.70	48.65
8	F 2522	15.95	10.52	56.99
9	ARBH-1502	15.96	15.67	63.78
10	HS 295	15.32	15.67	66.86
11	PBH 29	15.56	19.14	111.91
12	RB-602	15.54	22.85	46.31
13	CPD-1501	15.57	15.60	70.60
14	CNHO12	15.63	10.38	93.12
15	SHM-55	17.01	10.85	97.95
16	CSH 2920	15.37	16.06	96.86
17	BGDS 1055	15.94	18.18	55.97
18	F 2532	16.49	20.01	171.70
19	CNH 126	16.45	25.34	143.54
20	GJHV-517	16.00	19.08	111.66
21	H 1478	15.54	12.00	110.18

22	RS 2815	16.36	17.58	124.34
23	Suraj	15.20	12.73	101.35
24	RAH 1271	16.04	16.83	124.94
25	CPD-1502	15.84	15.78	62.26
26	TCH 1716	16.36	16.60	53.32
27	CCH 15-1	16.34	17.96	93.81
28	HS 296	16.25	16.35	103.25
29	GSHV-172	16.28	19.54	60.43
30	TSH 322	15.75	16.52	100.40
31	PBH 21	17.18	13.33	86.89
32	BGDS 1033	16.04	21.07	77.41
33	GJHV-519	15.81	11.87	64.29
34	RS 2797	16.39	10.98	107.93
35	TCH 1824	16.01	17.72	98.27
36	L – 799	16.82	14.31	88.23
37	RB-601	16.87	14.59	90.66
38	CCH 15-2	17.07	13.33	127.27
	Mean	**16.19**	**16.75**	**85.56**
	S.Em.±	0.29	0.4	0.6
	C.D. @5%	0.87	1.12	1.7
	C.V. (%)	3.09	4.13	1.22

Table 3: Evaluation of cotton genotypes for relative content of saturated and unsaturated fatty acids in percentage

Type of Fatty Acid/ Name of entry	ARBH-1501	SHM-55	PBH 21	CCH 15-2
Saturated Fatty Acid	29.05	26.64	27.90	28.96
Unsaturated Fatty Acid	70.95	73.36	72.10	71.04
*** Mono-Unsaturated Fatty Acid**	19.62	20.12	18.15	18.70
*** Poly-Unsaturated Fatty Acid**	51.33	53.24	53.95	52.34

Fig. 1: Area % of fatty acid in different genotypes



FA.1	Tetradecanoic acid, methyl ester
FA.2	Hexadecanoic acid, methyl ester
FA.3	9-Hexadecenoic acid, methyl ester, (Z)-
FA.4	Octadecanoic acid, methyl ester
FA.5	9-Octadecenoic acid (Z)-, methyl ester
FA.6	9-Octadecenoic acid, methyl ester
FA.7	9,12-Octadecadienoic acid (Z,Z)-, methyl ester
FA.8	9,12,15-Octadecatrienoic acid, methyl ester
FA.9	Eicosanoic acid, methyl ester
FA.10	Docosanoic acid, methyl ester