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Proximate Analysis of New Hybrid Varieties of Cottonseed (Gossypium)

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Abstract:*Variation in proximate analysis of the new hybrid varieties of* ***cottonseeds,****and extracted seed oil from three varieties (KCH – 14K59BG – II, Ajeet – III BG – II and Tulasi – 144 BG- II) of cotton (Gossypium) were studied. The analysis of new hybrid variety of cottonseeds depicts its agronomic characteristics. The analysis of seeds determines moisture, ash and its analysis, oil content, crude protein, crude fibre, calcium, CHN content. The analysis of moisture content infers the amount of oil present in seed. In CHN estimation, Carbon and Hydrogen content, determines the structure of unknown compound, and from Nitrogen content, the amount of protein can be estimated.The values obtained are Moisture content (5.94%, 6.71% and 8.10%), Ash (5.31%, 4.85%, and 5.04%), Alkalinity of Water Soluble Ash (0.008N, 0.0023N and 0.002N), Water Insoluble Ash (63.71%, 75.05% and 77.42%), Water Soluble Ash (36.29%, 24.95% and 22.58%), Oil (32.92%, 28.35% and 33.15%), Crude Protein (36.38%, 34.00% and 32.69%), Crude Fibre (0.10%, 0.12% and 0.12%), Calcium (1%, 0.99% and 1.20%), Nitrogen content (5.82%, 5.44% and 5.23%), Carbon content (53.31%, 53.03% and 54.07%), Hydrogen content (7.96%, 8.73% and 8.98%). Above analysis depicts the potential of cottonseed and how this analysis would prove pivotal while selecting appropriate cotton variety in specific area.*

Keywords:*Cottonseed, Cottonseed oil, Proximate composition.*

I. Introduction

Cotton is a primarily crop, which grows in tropical and subtropical warm humid climate. It is native to Americas, Africa, China and India. It belongs to *Malvaceae*familyand the genus*Gossypium*. Forcommercial purposes it is grown as annual crop. Four main species of cotton are found commercially viz.*G.hirsutum, G. barbadense, G. arboretum* and *G.herbaceum*.[1, 2]Various other species have been developed by conventional breeding methods for producing cotton plants having enhanced agronomic characteristics.

At global level, largest producers of cotton are China 34 million bales, followed by India 27 million bales. India is 2nd largest producer and consumer of cotton after China. White gold cotton is India's largest cash crop, accounting for a third of farm GDP. Large number of families in rural areas depends on cotton for their living. Production of cotton seed in 2012-2013 is 10.2million tonnes. Also out of 4.95 million ton production of cottonseed oil in world, India's share is 1.11 million ton.[3]

Cottonseed and cottonseed oil has varied implications. Cottonseed meal can be used as a dry organic fertilizer due to presence of 45% protein and other natural nutrients.[3] Cottonseed oil is popular for frying purposes, and is less expensive compared to olive oil or canola oil. Due to its flavour stability it is used for salad dressing and mayonnaise. Fine quality oil extracted from cottonseed is used in lubricants, paints, bath soaps and moisturizing lotions.[4] The outer cover of cottonseed is a rich source of protein and cellulose, and also cost effective animal feed. The oil has also been explored as a feedstock for biodiesel production.

II. Materials and Methods

Sample collection: The seeds of three varieties of cotton (*Gossypium*) namely KCH – 14K59BG – II, Ajeet – III BG – II and Tulasi – 144 BG- II were collected from fields of different areas of Jalgaon district of Maharashtra, India. For each variety 2 Kg seeds were taken. After removing the threads of cotton attached to the seeds, they were crushed and stored in air tight polythene bags and used for different analysis.

Moisture content: The powdered cottonseeds (2g) were oven dried for 2 hours at 110°C and loss in weight was recorded. This was done because, the lesser the moisture content, the more the oil yield.[5, 6]

Ash and its analysis: Seed powder (5g) was ignited to ash into a previously weighed silica crucible. Then it was cooled in desiccator and weighed. The increase in weight that occurred was taken as ash content. From this ash, percentage of water soluble ash and water insoluble ash were determined. Further alkalinity of water soluble ash was determined by titrating water soluble ash filtrate against 0.1N Sulphuric acid using Methyl orange as indicator.[5, 6]

Oil extraction: The ground cottonseed (10g) was placed on a filter paper and it was then properly folded and inserted into the assembled soxhlet apparatus using 100cm^3 of petroleum ether (40-60)°C as extracting solvent for 18 to 20Hours. The oil obtained after the excess solvent removed. The crude cottonseed oil was then packed and properly stored.[7]

Crude fibre: Finely powdered seeds (3g) were extracted with petroleum ether (40-60) °C for 18 hours. The defatted powder transferred to dry 100 cm^3 conical flask. 20cm^3 of 0.25 N Sulphuric acid was added and it was brought to boiling. Boiling was continued for 30 minutes. The contents were filtered and insoluble matter was washed with boiling water till it was free from acid. The residue was again washed into flask along with 20$cm^3$of 0.313N sodium hydroxide. The contents were boiled for 30 minutes. The insoluble matter was transferred to filter paper by means of boiling water, followed by 1% hydrochloric acidand again with boiling water until it became free from acid. Then it was washed twice with alcohol and thrice with ether. It was transferred to ash-less filter paper and dried at 110°C to constant weight. The filter paper and its contents were incinerated and ignited to ash in a previously weighed silica crucible. Increase in weight of silica crucible is reported as crude fibre.[8, 9]

Calcium: About 0.5g of seed powder was dissolved in 10 $cm^3$of 1:1 HCl in beaker. It was heated on sand bath to evaporate the content to dryness and cool it. 5 cm^3 of conc. HCI and 1cm^3 of conc. HNO_3 was added to it and heat to make it evaporate to dryness. Then 20cm^3 of distilled water was added and boiled. This solution was filtered and collected in 250 cm^3 standard flask. It was diluted and used as stock solution. This stock solution was titrated against 0.05 M EDTA using buffer pH 10 and Eriochrome Black T as indicator to determine Calcium content.

CHN estimation: Carbon, Hydrogen and Nitrogen in the cotton seed powder were estimated by Elemental Analyser method. From Nitrogen content,CrudeProtein was determined.[15]

Wp = 0.625 Wn %

Where,
Wp is the crude protein content, expressed in grams per kilogram or in percent;
Wn is the Nitrogen content, in grams per kilogram, of the test sample

III. Results and Discussion

Results: The data for the proximate analysis of selected varieties (KCH – 14K59BG – II, Ajeet – III BG – II and Tulasi – 144 BG- II) of cottonseed harvested from different areas of Jalgaon are given inTable 1.

Table 1: Proximate composition of different varieties of cottonseed.

Constituent (%)	Varieties		
	KCH - 14K59 BG-II	Ajeet - III BG-II	Tulasi - 144 BG-II
Moisture	5.94±0.006	6.71±0.002	8.10±0.003
Ash	5.31±0.004	4.85±0.0006	5.04±0.0006
Water soluble ash	36.29±0.149	24.95±0.022	22.58±0.012
Water insoluble ash	63.71±0.149	75.05±0.022	77.42±0.012
Oil	32.92	28.35	33.15
Crude Protein	36.38	34.00	32.69
Defatted seed	67.08	71.65	66.85
Crude fibre	0.10	0.12±0.0006	0.12±0.0006
Calcium	1.00	0.99	1.20
Nitrogen content	5.82	5.44	5.23
Carbon content	53.31	53.03	54.07
Hydrogen content	7.96	8.73	8.98

*Values are means ± SD (n=3), calculated as percentage on dry seed weight basis.

The three different varieties (KCH – 14K59 BG-II, Ajeet – III BG-II and Tulasi – 144 BG-II) of cottonseed were studied for proximate analysis. The values obtained are Moisture content (5.94%, 6.71% and 8.10%), Ash (5.31%, 4.85%, and 5.04%),Water Insoluble Ash (63.71%, 75.05% and 77.42%), Water Soluble Ash (36.29%, 24.95% and 22.58%) as shown in figure1,

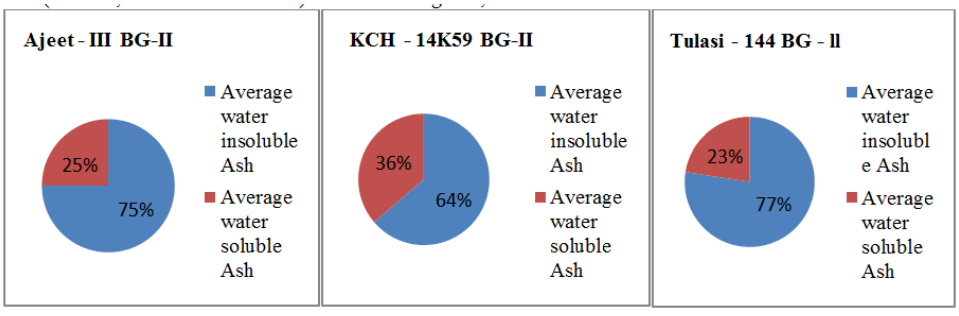

Figure 1: Ash analysis of hybrid cotton seed

Oil (32.92%, 28.35% and 33.15%), Crude Protein (36.38%, 34.00%, and 32.69%), Crude Fibre (0.10%, 0.12% and 0.12%), Calcium (1%, 0.99% and 1.20%), Nitrogen content (5.82%, 5.44% and 5.23%), Carbon content (53.31%, 53.03% and 54.07%), Hydrogen content (7.96%, 8.73% and 8.98%) respectively.

Discussion: The table-1 and figure-2 shows proximate composition of different varieties of cottonseed. Three varieties KCH – 14K59 BG-II, Ajeet – III BG-II and Tulasi – 144 BG-II are considered on various accounts. The cottonseed moisture contents were in the range 5.94% to 8.10%. KCH – 14K59 BG-II has less moisture (5.94%) than Ajeet – III BG-II (6.71%) and that of Tulasi – 144 BG-II is highest (8.10%).

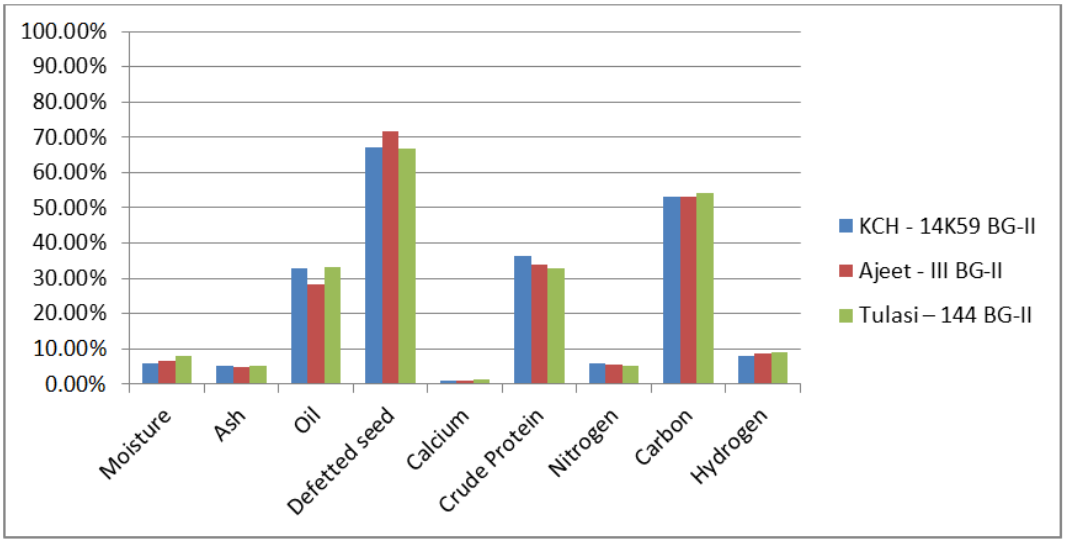

Figure 2: variation in comparative analysis of hybrid cotton.

The moisture content found in all three varieties is quite low in comparison with commercial standard which is 9.18%.[10] The low moisture supports the fact that seeds can be stored for a longer time in good condition. The amount of ash is lowest in Ajeet – III BG-II (4.85%) and there is marginal difference in percentage of Tulasi – 144 BG-II (5.04%) and KCH – 14K59 BG-II (5.31%). The percent found in all varieties is higher in comparison to the commercial parameter (4.06%).[10] Further water soluble ash is highest in KCH – 14K59 BG-II (36.29%) followed by Ajeet – III BG-II (24.95%) and least in Tulasi – 144 BG-II (22.58%). Water insoluble ash is least in KCH – 14K59 BG-II (63.71%), moderate in Ajeet – III BG-II (75.05%) and highest in Tulasi – 144 BG-II (77.42%).

The oil content found is least in Ajeet – III BG-II (28.35%) and there is minimal difference between KCH – 14K59 BG-II (32.92%) and Tulasi – 144 BG-II (33.15%). Cottonseed oil yield is controlled by multiple genes and strongly influenced by the environment factors.[11, 14]Seed oil content in the present analysis were higher compared to several other cotton species primarily *G. arboretum* (14.4 – 18.7)%, *G .hirsutum* (15.8 - 20.2)%[12, 14]and *G.arboretum*(22.89%).The crude protein is in the range 32.69% to 36.38%. It is highest in KCH – 14K59BG – II (36.38%) followed by Ajeet – III BG – II (34%) and Tulasi – 144 BG- II (32.69%). The range is found to be higher compared to commercial standard which is 17.62%.[10]The present analysis proposes the cotton meal to be a good source of protein that could be used as energy source in poultry feed as well as for bio-fertilizer applications. The percentage of defatted seed is more in Ajeet – III BG-II (71.65%) and the difference between KCH – 14K59 BG-II (67.08%) and that of Tulasi – 144 BG-II (66.85%) is marginal.

The percentage of crude fibre is least in KCH – 14K59 BG-II (0.10%) and that of Ajeet – III BG-II (0.12%) and Tulasi – 144 BG-II (0.12%) is equal. This is found to be in great variation with the commercial value of (18.49%).[10] The amount of calcium is lowest in Ajeet – III BG-II (0.99%) and in KCH – 14K59 BG-II (1.00%) and highest in Tulasi – 144 BG-II (1.20%). In all three varieties the percentage found is greater in accordance with standard value of 0.17%.[13] The Nitrogen content found shows marginal difference in all three varieties KCH – 14K59 BG-II (5.82%), Ajeet – III BG-II (5.44%) and Tulasi – 144 BG-II (5.23%). The Carbon content in the seeds ranges between (54.07 to 53.03)%. It is highest in Tulasi – 144 BG-II (54.07%) and it is (53.31%) in KCH – 14K59 BG-II followed by Ajeet – III BG-II (53.03%). The hydrogen found is lowest in KCH – 14K59 BG-II (7.96%) and highest in Tulasi – 144 BG-II (8.98%) and that of Ajeet – III BG-II (8.73%) is moderate.

IV. Conclusion

The new hybrid varieties of cottonseeds are good source of oil. They contain less moisture. The calcium deficiency issues can be mitigated by introducing the cottonseed oil extracted from these varieties of cottonseed in our daily diet. The study of these seeds might be beneficial forselection and cultivation of such cotton seed variety which would yield maximum nutritional benefits.

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