

STUDIES IN BRACTS, BURS, LINT COLOUR AND FOREIGN MATTER IN SOME PAK COTTONS

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Regular studies in bracts, burs, dirt, colour and foreign matter in high grade cottons were undertaken at Lyallpur during the years 1962-63 and 1963-64. The size of burs and bracts was found to be large in general. The percentage of shedding of burs was 0.0 to 3.5 in the first year and 0.0 to 3.7 percent in the second year. Shedding of bracts ranged from 8.5 to 35.7 percent in 1962-63 and 9.5 to 31.6 percent in 1963-64. The lint colour was found to be white in most of the cases, although slight variations existed due to varietal and environmental effects. The results indicated scope for improvement of colour grades by selection. The foreign matter content during both the years showed scope for reduction through selection, the actual range being 0.68 to 6.1 grams per plant as compared to 3.4 and 5.7 grams for L.S.S. during the first and second year respectively. The present programme of developing high grade cottons will, therefore, result in small bracts, high shedding of foliage at first pick and low foreign matter content.

The significance of cotton grades in determining quality in the present day marketing systems in developed and advanced countries has been realized, as it is the single major factor which determines the price of cotton and helps in appraisal of processing waste and losses, which is composed of colour, foreign matter and ginning preparation. The colour denotes weathering conditions to which cotton has been subjected and in certain cases gives information pertaining to attack of insects and fungi, both before and after the boll has opened. Fibre deterioration or discolouration is caused by soil, climatic conditions, rain, dust storms and contact with burs, leafy and foreign matter.

Foreign matter includes dried and broken plant foliage of various kinds, pieces of burs, motes, seed coat fragments and sometimes sand and dust.

Bract is a small leaf, a scale below the calyx, which on drying and opening of boll is a source of serious troubles, through mixing of its dry pieces of leaves with the lint or seed cotton. A bur is the clinging seed vessel or skeleton of the boll containing seed cotton, which is also a source of considerable trouble, through mixing of burs or its dry pieces with seed cotton at the picking time.

The type of bracts and burs etc. and extent of their shedding percentage, the colour and the extent of foreign matter which are all varietal characters are subject to control at different stages, either mechanically by removal of burs, trash and foreign matter etc., through effective ginning or through proper application of breeding techniques and development or breeding of cotton varieties, which may have smaller and deciduous bracts; non breakable burs, and which may shed leaves before first picking, so that chances of pieces

of bracts, foliage and burs getting mixed up and entangled in cotton may be eliminated altogether.

The present studies cover all these points to a certain extent and are a step in the right direction for improvement of cotton grades in Pakistan. It included determination of size of bracts and burs, percentage of shedding of bracts and burs by first picking; colour of lint and the foreign matter in selections of Pak-111, AC-134, AC-158, AC-192, AC-256, AC-275, AC-306 and Pak-8 during the years 1962-63 and 1963-64. The interesting findings of these researches are presented in this paper.

Review of Literature

The available literature is briefly reviewed herewith:

The importance of cotton grades has been discussed in considerable details by Bur. Agri. Econ. The various components of grade i.e., colour, foreign matter, ginning preparation and their effects on spinning have also been studied by Dick,⁶ Webb and Richardson^{4,11} Gerdes,⁸ the influence of environments on grades, five other fibre quality characters and spinning performance has been reported by Barker and Berkley,⁵ Hancock² Gerdes.⁸

Dick⁶ stated that grades were controlled largely by two factors, colour and foreign matter. Soil, climatic conditions, rain and cloudy weather tend to discolour the fibres through biological deterioration, wind and splash of rain on soils of various types and colours bring about spotted and tinged classifications. Diseases and insects also play their part in causing fibre deterioration and discolouration.

Bur. Agri. Econ.¹ reported that cotton had higher grades in the early part of the season; it is bright in colour and does not carry an appreciable amount of leaf. Bolls opening after frost may be tinged or stained a yellow colour. Spotted cotton arises from ginning of such bolls with normally opening bolls. Such spots are also caused by insect injury and in locations of red or black soils, with the inclusion of bolls that fall on the ground and became land stained. Mottled cotton arises from mixing of tinged or stained bolls with bolls dulled by exposure. The open cotton left in the field exposed to weather becomes darker and dull in colour and is lower in grade. Gaines^{5a} discussed the effects of foreign matter grade, staple and price of cotton. Gerdes⁸ stated that time and method of harvesting also determines to a measurable degree the grade element of quality made at a gin. Dick⁶ stated that machine picked cotton invariably gives lower grades than hand picked cotton. Grades are higher in the beginning of the season and drop as the season progresses. Similar opinions were expressed by other workers and in the Texas Experiment Station, Annual Report. Brown and Hayder^{1a} discussed the influence of varietal differences on the grades of cotton. Dick⁶ showed no consistent differences in colour grades between the commercial varieties most commonly grown in the area, either from cotton early picked or cotton exposed to the weather for 3 months. Harrison^{5b} reported that biological deterioration from prolonged exposure had been materially reduced or at least substantially delayed by higher wax content in an Acala strain. It was, however, possible that minor varietal differences exist in colour after prolonged exposure due to this very factor.

Early Texas Workers, Sl. Galhoun and E.C. Ewing concluded that smooth leaf cottons generally gave higher grades, than the hairy varieties and that leaf trash was main factor in grade differential. The characters like pilosity of leaves caused greater adherence of leaf trash to

lint. Dunnam and Clark^{3a} observed appreciable adherence of fallen pilose leaves to open cotton than glabrous leaves. Studies with Delfta Smooth leaf variety released in 1947 showed increased percentage of trash removal with decrease in pilosity.

Isac and Henderson^{11a} obtained higher grades from all smooth leaf types in F₂ progenies of Delta Smooth Leaf and Stoneville 2B, but in none of the crosses were grades as high as the parent smooth leaf. The size and position of the bracts in these progenies were also found to influence grade to a certain extent. Similar views were expressed by Lund and Meyer.¹⁷

Gull and Adams³ reported that defoliation with chemicals resulted in early opening of bolls and that defoliation considerably reduced the total green and dry leaf material collected by the picking machine.

Harrison⁹ described the breeding and adapting the cotton varieties to mechanization.

Material and Methods

Regular studies were conducted during the years 1962-63 and 1963-64 at Lyallpur for breeding of cotton varieties shedding leaves before 1st picking with special reference to bracts, burs, lint colour, foreign matters and fibre quality. The breeding material included 48 families during both the years. It was raised originally from 26 best plants of Pak-111, 18 best plants from the promising varieties AC-134, AC-158, AC-192, AC-256, AC-275, AC-306 and Pak-8 alongwith 4 standard varieties L.S.S., AC-134, AC-307 and Pak-111. The details of the experiments were as under:

Methods Employed

Bracts, Burs, their Size and Shedding.—The size of bracts and burs was taken with a scale in centi-

S. No.	Particulars	1962-63	1963-64
1.	Number of progenies	44	44
2.	Standards (LSS, AC134, AC307 and Pak-111).	4	4
3.	Total number of families	48	48
4.	No. of plants per bed per repeat	5	5
5.	Replications	6	6
6.	Design of lay-out	Complete randomiza- tion 49.0-145	Complete randozima- 91.7-325.0
7.	Range of ginning outturn(%)	30.0-40.0	33.2- 43.4
8.	Range of staple length (m.m.)	23.5-27.0	21.5- 24.5
9.	Rainfall during the cotton season	7.60 inches	6.23 inches

meters and inches respectively. The shedding was studied by the formula given below after classification of burs as large, medium and small according to the following standards:

0.1-2.5 cm long	=Small
2.5-3.5 cm long	=Medium
3.5 and longer	=Large

The size of burs was classified as follows:

0.25-1.25 cm diameter	=Small
1.25-2.25 cm diameter	=Medium
2.5 and longer	=Large
Percentage of shedding of bracts	=Bracts shed
	$\frac{\text{---}}{\text{---}} \times 100$
	Total No. of bracts

Percentage of shedding of burs	=Total burs shed
	$\frac{\text{---}}{\text{---}} \times 100$
	Total No. of burs

Lint Colour.—It was recorded at the time of ginning by visual observation. The colour of each sample was seen and the more frequent shade of colour was taken as the normal colour. Any departure from this colour was due to some abnormality in picking practice or due to long exposure of the shed cotton to weather.

Foreign Matter.—The entire seed cotton from the three pickings was hand cleaned to remove foreign matter like dried leaves, dirt, burs etc. Seed cotton was then weighed for determination of foreign matter by differences between cleaned and uncleaned cotton.

Experimental Results

The relevant data pertaining to bracts, burs, lint colour and foreign matter are given in Appendices I to VII.

It will be seen from data given in Appendices I and II that all families during the year 1962-63 possessed large or medium sized burs and bracts, and no family had small sized burs and bracts, whereas during the year 1963-64, most of the families had large burs and bracts, only 13 families showed medium sized burs and no family had small burs. On the other hand six families during the second year showed medium sized bracts and only three families had small sized bracts.

The shedding of burs under Lyallpur conditions were negligible and the actual values ranged from 0.0 to 3.5 per cent during the first year and 0.0 to 5.7 per cent during the 2nd year. The shedding of bracts, however, was 8.5 to 35.7 per cent in the first year and 9.5 to 31.6 during the second year.

Lint Colour.—The lint colour was determined in the entire breeding material during both the years and it was found to be white in all families and standards during the two seasons.

The data given in Appendix III shows that the colour of lint was white in all families during both the years. Some families did show some variation from the normal colour in certain cases, but it was due to long exposure of the lint to severe weather conditions i.e. dew, frost and abnormal picking practices, etc.

It will be seen from data presented in Appendices VI and V that the range of values of foreign matter was from 0.68 to 6.1 g per plant in 1962-63 and 1.6 to 6.4 g per plant in 1963-64. The standard cotton Pak-111 was comparatively free of foreign matter in the first year and showed 3.2 per cent foreign matter content during the second year, whereas LSS the major commercial variety of Lyallpur zone recorded 3.4 and 5.7 g. foreign matter per plant in the first and 2nd year respectively. The other standard cotton AC-134 and AC-307 recorded 4.5 and 4.6 grams foreign matter respectively in 1962-63 and 3.2 and 5.4 g. foreign matter during 1963-64.

Twelve families showed less foreign matter content than L.S.S. in 1962-63 and 44 families possessed less foreign matter than L.S.S. during the second year which showed that selection for higher grades in 1962-63 resulted in superior material as larger number of families of Pak-111 found better in foreign matter contents than the main standard variety L.S.S.

The consolidated data for shedding of burs, bracts and foreign matter content along with values of yield, ginning outturn and staple length are given in Appendices VI and VII.

It will be seen from the consolidated data presented in Appendices VI and VII that the foreign matter contents in L.S.S., the late maturing major commercial variety of Lyallpur tract during the two years (1962-63 and 1963-64) was 3.4 and 5.7 grams per plant respectively; whereas the percentage of shedding of burs was 0.0 during both the years and shedding of bracts was 29.8 and 25.9 percent during the first and 2nd year respectively. The yield of seed cotton in case of L.S.S. variety was found to be 74.0 and 81.3 grams during 1962-63 and 1963-64; ginning outturn percent was 35.6 and 33.1 during the 1st and 2nd year and staple length was 24.9 and 21.00 mm. during the years 1962-63 and 1963-64 respectively.

On the other hand the percentage of foreign matter in AC-307 and AC-134 standards types

APPENDIX I

Size of Bracts and Burs and Shedding for the year 1962-63.

S. No.	Family	Origin	Size of burs	Size of bracts	Shedding % at 1st pick	
					Burs	Bracts
1.	1110-62	Pak-111	Large	Medium	3.0	25.0
2.	1111-62	Pak-111	Large	Medium	0.0	10.5
3.	1112-62	Pak-111	Large	Large	0.0	13.9
4.	1113-62	Pak-111	Large	Large	0.0	17.5
5.	1114-62	Pak-111	Large	Large	1.5	14.5
6.	1115-62	Pak-111	Large	Large	2.5	20.0
7.	1116-62	Pak-111	Large	Medium	0.0	27.5
8.	1117-62	Pak-111	Large	Large	0.0	17.5
9.	1118-62	Pak-111	Large	Large	0.0	13.5
10.	1119-62	Pak-111	Large	Large	0.0	12.5
11.	1120-62	Pak-111	Large	Large	0.0	9.5
12.	1121-62	Pak-111	Large	Large	0.0	21.7
13.	1122-62	Pak-111	Large	Large	0.0	12.4
14.	1123-62	Pak-111	Medium	Large	0.0	25.5
15.	1124-62	Pak-111	Medium	Large	0.0	28.5
16.	1125-62	Pak-111	Medium	Medium	1.0	27.6
17.	1126-62	Pak-111	Medium	Medium	3.5	15.7
18.	1127-62	Pak-111	Large	Medium	3.0	16.9
19.	1128-62	Pak-111	Large	Medium	2.5	17.7
20.	1229-62	Pak-111	Large	Large	0.0	11.7
21.	1130-62	Pak-111	Large	Large	0.0	9.1
22.	1131-62	Pak-111	Medium	Large	0.0	19.5
23.	1132-62	Pak-111	Large	Large	0.0	21.4
24.	1133-62	Pak-111	Large	Medium	0.0	20.5
25.	1134-62	Pak-111	Medium	Large	0.0	20.5
26.	1135-62	Pak-111	Medium	Large	0.0	17.5
27.	1136-62	Pak-8	Medium	Large	1.0	12.3
28.	1137-62	Pak-8	Large	Large	1.5	15.7
29.	1138-62	AC-306	Large	Large	0.0	16.9
30.	1139-62	AC-306	Large	Large	0.0	25.9
31.	1140-62	AC-134	Large	Large	0.0	27.7
32.	1141-62	AC-134	Large	Large	0.0	18.5
33.	1142-62	AC-192	Medium	Large	0.0	8.5
34.	1143-62	AC-192	Large	Large	0.0	24.6
35.	1144-62	AC-158	Large	Large	0.0	23.1
36.	1146-62	320-F	Medium	Large	0.0	21.7
37.	1147-62	320-F	Medium	Medium	0.0	14.5
38.	1148-62	AC-256	Medium	Large	0.0	12.4
39.	1149-62	AC-256	Medium	Large	0.0	17.1
40.	1150-62	AC-256	Large	Large	2.5	19.2
41.	1151-62	AC-157	Large	Large	0.0	21.4
42.	1152-62	AC-157	Large	Large	0.0	27.9
43.	1153-62	AC-310	Large	Large	0.0	31.4
44.	Pak-111	Standard	Large	Medium	1.5	35.7
45.	L.S.S.	Standard	Large	Medium	0.0	29.8
46.	AC-134	Standard	Large	Medium	0.0	26.7
47.	AC-307	Standard	Large	Medium	0.0	29.5

APPENDIX II

Size of Bracts, Burs and Shedding for 1963-64.

S. No.	Family	Origin	Size of burs	Size of bracts	Shedding % at 1st pick	
					Burs	Bracts
1.	985-63	Pak-III	Large	Large	0.0	12.5
2.	987-63	Pak-III	Large	Large	0.0	13.7
3.	988-63	Pak-III	Large	Large	0.0	18.5
4.	989-63	Pak-III	Large	Large	0.0	27.7
5.	990-63	Pak-III	Large	Large	0.0	29.5
6.	991-63	Pak-III	Large	Large	1.5	12.5
7.	992-63	Pak-III	Large	Large	3.7	18.9
8.	993-63	Pak-III	Large	Large	3.5	13.5
9.	994-63	Pak-III	Large	Large	2.5	21.7
10.	995-63	Pak-III	Medium	Large	0.0	24.5
11.	996-63	Pak-III	Large	Large	0.0	23.7
12.	997-63	Pak-III	Large	Large	0.0	22.5
13.	998-63	Pak-III	Large	Large	0.0	26.6
14.	999-63	Pak-III	Large	Large	1.5	31.6
15.	1000-63	Pak-III	Large	Large	0.0	18.5
16.	1001-63	Pak-III	Large	Medium	0.0	13.5
17.	1002-63	Pak-III	Large	Small	0.0	27.7
18.	1003-63	Pak-III	Large	Small	2.5	12.5
19.	1004-63	Pak-III	Large	Large	0.0	9.5
20.	1005-63	Pak-III	Large	Large	0.0	18.5
21.	1006-63	Pak-III	Large	Large	2.0	11.7
22.	1007-63	Pak-III	Large	Medium	0.0	25.7
23.	1008-63	Pak-III	Large	Large	0.0	21.6
24.	1009-63	Pak-III	Medium	Small	2.0	17.9
25.	1010-63	Pak-III	Medium	Large	0.0	21.4
26.	1011-63	Pak-III	Large	Large	0.0	25.7
27.	1012-63	Pak-III	Large	Large	0.0	18.5
28.	1013-63	Pak-8	Large	Large	0.0	17.6
29.	1014-63	Pak-8	Large	Large	0.0	17.6
30.	1015-63	AC-306	Large	Large	0.0	11.6
31.	1016-63	AC-306	Large	Small	0.0	12.5
32.	1017-63	AC-306	Large	Large	0.0	27.9
33.	1018-63	AC-306	Large	Large	0.0	25.9
34.	1019-63	AC-134	Large	Large	0.0	23.3
35.	1020-63	AC-134	Large	Large	0.0	16.7
36.	1021-63	AC-158	Large	Large	0.0	13.5
37.	1022-63	AC-158	Large	Large	1.5	24.5
38.	1023-63	AC-158	Large	Large	0.0	23.7
39.	1024-63	AC-158	Large	Large	0.0	23.7
40.	1025-63	AC-275	Large	Medium	3.7	15.6
41.	1026-63	AC-275	Large	Medium	5.7	12.5
42.	1027-63	AC-256	Medium	Medium	3.5	16.9
43.	1028-63	AC-256	Large	Medium	0.0	17.6
44.	Pak-III	Standard	Large	Large	0.0	18.5
45.	L.S.S.	Standard	Large	Large	0.0	25.9
46.	AC-134	Standard	Large	Large	0.0	22.2
47.	AC-307	Standard	Large	Large	0.0	18.6

APPENDIX III

Lint Colour of the Different Families

Year	Total No. of families	Family members	Origin	Lint colour	
1962-63	26	1110-62 to 1135-62	Pak-111	White	
	2	1136 & 1137/62	Pak-8	White	
	2	1138 & 1139/62	AC-206	White	
	2	1140 & 1141/62	AC-134	White	
	2	1142 & 1143/62	AC-192	White	
	1	1144/62	AC-158	White	
	2	1146 & 1147/62	320-F	White	
	3	1148 to 1150/62	AC-256	White	
	2	1151 & 1152/62	AC-157	White	
	1	1153/62	AC-301	White	
	4	Pak-111, AC-134 L.S.S. & AC-307	Standards	White	
	1963-64	27	985/63 to 1012/63	Pak-111	White
		2	1013 & 1014/63	Pak-8	White
4		1015 to 1018/63	AC-306	White	
2		1019 & 1020/63	AC-134	White	
4		1021 to 1024/63	AC-158	White	
2		1025 to 1026/62	AC-275	White	
2		1027 & 1028/62	AC-256	White	
4		Pak-111, AC-134, L.S.S. & AC-307	Standards	White	

APPENDIX IV

Foreign Matter in Different Families during 1962-63

S. No.	Family	Origin	Foreign matter g.	S. No.	Family	Origin	Foreign matter g.
1	1123-62	Pak-111	6.1	25	1125-62	Pak-111	3.8
2	1114-62	Pak-111	5.7	26	1122-62	Pak-111	3.8
3	1120-62	Pak-111	5.6	27	1112-62	Pak-111	3.6
4	1143-62	AC-192	5.6	28	1115-62	Pak-111	3.6
5	1127-62	Pak-111	5.1	29	1126-62	Pak-111	3.6
6	1142-62	AC-192	5.0	30	1134-62	Pak-111	3.5
7	1136-62	Pak-8	4.9	31	1137-62	Pak-8	3.5
8	1118-62	Pak-111	4.8	32	1110-62	Pak-111	3.4
9	1139-62	AC-306	4.8	33	1152-62	AC-157	3.4
10	1147-62	320-F	4.8	34	Pak-111	Standard	3.4
11	1130-62	Pak-111	4.7	35	L.S.S.	Standard	3.4
12	AC-307	Standard	4.6	36	1116-62	Pak-111	3.3
13	AC-134	Standard	4.5	37	1151-62	AC-157	3.2
14	1124-62	Pak-111	4.4	38	1140-62	AC-134	3.1
15	1129-62	Pak-111	4.3	39	1141-62	AC-134	3.1
16	1135-62	Pak-111	4.3	40	1153-62	AC-301	2.9
17	1131-62	Pak-111	4.2	41	1128-62	Pak-111	2.8
18	1133-62	Pak-111	4.2	42	1144-62	AC-158	2.7
19	1119-62	Pak-111	4.1	43	1117-62	Pak-111	2.2
20	1132-62	Pak-111	4.1	44	1149-62	AC-256	2.1
21	1150-62	AC-256	3.9	45	1138-62	AC-306	1.0
22	1146-62	320-F	3.8	46	1121-62	Pak-111	1.1
23	1148-62	AC-256	3.8	47	1111-62	Pak-111	0.68
24	1113-62	Pak-111	3.8				

APPENDIX V

Foreign Matter in Different Families during 1963-64.

S. No.	Family	Origin	Foreign matter g.	S. No.	Family	Origin	Foreign matter g.
1	1121-63	AC-158	6.4	24	985-63	Pak-111	3.9
2	1123-63	AC-158	6.2	25	1014-63	Pak-8	3.9
3	L.S.S.	Standard	5.7	26	1025-63	AC-275	3.6
4	1024-63	AC-158	5.4	27	1015-63	AC-306	3.6
5	AC-307	Standard	5.4	28	1009-63	Pak-111	3.5
6	1028-63	AC-256	5.3	29	1020-63	AC-134	3.5
7	990-63	Pak-111	5.2	30	997-63	Pak-111	3.4
8	1007-63	Pak-111	5.2	31	1001-63	Pak-111	3.4
9	1027-63	AC-256	5.2	32	1003-63	Pak-111	3.3
10	1008-63	Pak-111	4.7	33	1016-63	AC-306	3.3
11	1026-63	AC-275	4.7	34	Pak-111	Standard	3.2
12	1018-63	AC-306	4.6	35	AC-134	Standard	3.2
13	987-63	Pak-111	4.5	36	988-63	Pak-111	3.0
14	1002-63	Pak-111	4.5	37	1019-63	AC-134	2.8
15	1004-63	Pak-111	4.5	38	999-63	Pak-111	2.6
16	1012-63	Pak-111	4.5	39	996-63	Pak-111	2.5
17	1014-63	Pak-8	4.4	40	1000-63	Pak-111	2.3
18	1011-63	Pak-111	4.3	41	998-63	Pak-111	2.1
19	1022-63	AC-158	4.3	42	1010-63	Pak-111	2.0
20	989-63	Pak-111	4.2	43	991-63	Pak-111	1.9
21	1017-63	AC-306	4.2	44	993-63	Pak-111	1.7
22	1006-63	Pak-111	4.1	45	994-63	Pak-111	1.7
23	1005-63	Pak-111	4.0	46	995-63	Pak-111	1.7

APPENDIX VI

Consolidated Statement for the Year 1962-63.

S. No.	Family	Origin	Shedding % at first pick		Foreign matter (g.)	Yield	Ginning outturn %	Staple length (mm)
			Burs	Bracts				
1	2	3	4	5	6	7	8	9
1.	1123-62	Pak-111	0.0	25.5	6.1	121.0	36.1	23.6
2.	1114-62	Pak-111	1.5	14.5	5.7	112.5	36.3	24.1
3.	1120-62	Pak-111	0.0	9.5	5.6	97.9	38.1	23.2
4.	1143-62	AC-192	0.0	24.6	5.6	110.0	35.2	24.2
5.	1127-62	Pak-111	3.0	16.9	5.1	99.4	37.0	24.5
6.	1142-62	AC-192	0.0	8.5	5.0	101.7	34.9	—
7.	1136-62	Pak-8	1.0	12.3	4.9	107.9	—	—
8.	1118-62	Pak-111	0.0	13.5	4.8	114.8	34.4	23.8
9.	1139-62	AC-306	0.0	25.9	4.8	127.1	37.8	24.2
10.	1147-62	320-F	0.0	14.5	4.8	124.7	37.0	24.6
11.	1130-62	Pak-111	0.0	9.1	4.7	105.2	36.8	23.3
12.	AC-307	Standard	0.0	29.5	4.6	104.6	36.9	28.1
13.	AC-134	Standard	0.0	26.7	4.5	84.2	34.4	21.7
14.	1124-62	Pak-111	0.0	28.5	4.4	89.3	35.7	24.2
15.	1129-62	Pak-111	0.0	11.7	4.3	98.8	—	—
16.	1135-62	Pak-111	0.0	17.5	4.3	97.3	—	—
17.	1131-62	Pak-111	0.0	19.5	4.2	91.8	36.3	23.6

(Continued)

Appendix VI (Continued)

1	2	3	4	5	6	7	8	9
18.	1133-62	Pak-111	0.0	20.5	4.2	85.9	—	—
19.	1119-62	Pak-111	0.0	12.5	4.1	82.2	33.6	24.1
20.	1132-62	Pak-111	0.0	21.4	4.1	105.8	36.0	23.4
21.	1150-62	AC-256	2.5	19.2	3.9	108.4	38.0	24.6
22.	1146-62	320-F	0.0	21.7	3.8	82.5	34.3	22.5
23.	1148-62	AC-256	0.0	12.4	3.8	115.1	40.8	24.2
24.	1113-62	Pak-111	0.0	17.5	3.8	97.6	37.7	23.8
25.	1125-62	Pak-111	1.0	27.6	3.8	107.7	36.5	22.3
26.	1122-62	Pak-111	0.0	12.4	3.7	96.9	36.8	24.9
27.	1112-62	Pak-111	0.0	13.9	3.6	79.9	36.0	22.8
28.	1115-62	Pak-111	2.5	20.5	3.6	106.2	37.6	23.2
29.	1126-62	Pak-111	3.5	15.7	3.6	76.4	—	—
30.	1134-62	Pak-111	0.0	20.5	3.5	92.7	36.6	23.5
31.	1137-62	Pak-8	1.5	15.7	3.5	97.8	35.1	33.1
32.	1110-62	Pak-111	3.0	25.0	3.4	81.5	—	24.9
33.	1152-62	AC-157	0.0	27.9	3.4	72.1	—	—
34.	Pak-111	Standard	1.5	35.7	3.4	87.9	35.2	24.2
35.	L.S.S.	Standard	0.0	29.8	3.4	74.5	35.6	24.9
36.	1116-62	Pak-111	0.0	27.5	3.3	89.9	—	—
37.	1151-62	AC-157	0.0	3.2	3.2	72.1	37.1	24.4
38.	1140-62	AC-134	0.0	27.7	3.1	98.6	35.7	23.9
39.	1141-62	AC-134	0.0	18.5	3.1	92.1	—	—
40.	1153-62	AC-301	0.0	31.4	2.9	85.4	35.8	—
41.	1128-62	Pak-111	2.5	17.7	2.8	70.2	36.6	24.4
42.	1144-62	AC-158	0.0	23.1	2.7	86.3	37.5	23.5
43.	1117-62	Pak-111	0.0	17.5	2.2	72.1	35.2	24.2
44.	1149-62	AC-256	0.0	17.1	2.1	53.6	40.2	26.1
45.	1138-62	AC-306	0.0	16.9	1.9	98.1	36.5	23.7
46.	1121-62	Pak-111	0.0	21.7	1.1	101.3	37.8	24.1
47.	1111-62	Pak-111	0.0	10.5	0.68	67.1	36.8	—

APPENDIX VII

Consolidated Statement of Burs and Bract Shedding, Foreign Matter Etc. 1963-64.

S. No.	Family	Origin	Shedding %		Foreign matter (gms.)	(Yield (grams))	Ginning outturn %	Staple length (mm)
			Burs	Bracts				
1	2	3	4	5	6	7	8	9
1.	1021-62	AC-158	0.0	13.5	6.4	129.5	35.9	23.0
2.	1023-63	AC-158	0.0	23.7	6.2	72.1	37.5	22.0
3.	L.S.S.	Standard	0.0	25.9	5.7	81.3	33.1	21.0
4.	1024-63	AC-158	0.0	23.7	5.4	102.6	37.1	22.0
5.	AC-307	Standard	0.0	18.6	5.4	122.0	33.8	22.0
6.	1028-63	AC-256	0.0	17.6	5.3	102.2	35.4	21.0
7.	990-63	Pak-111	0.0	29.5	5.2	84.6	36.5	21.0
8.	1007-63	Pak-111	0.0	25.7	5.2	85.0	39.8	24.0
9.	1027-63	AC-256	3.5	16.9	5.2	97.2	38.4	23.0
10.	1008-63	Pak-111	0.0	21.6	4.7	98.7	34.8	22.0
11.	1026-53	AC-275	5.7	12.5	4.7	90.4	34.1	23.0

(Continued)

Appendix VII (Continued)

1	2	3	4	5	6	7	8	9
12.	1018-63	AC-306	0.0	25.9	4.6	107.0	38.1	22.0
13.	987-63	Pak-111	0.0	13.7	4.5	91.7	35.8	22.0
14.	1002-63	Pak-111	0.0	27.7	4.5	70.3	36.3	22.0
15.	1004-63	Pak-111	0.0	9.5	4.5	87.3	35.8	20.0
16.	1012-63	Pak-111	0.0	18.5	4.5	86.2	35.5	20.0
17.	1013-63	Pak-8	0.0	17.6	4.4	83.6	33.7	21.0
18.	1011-63	Pak-111	0.0	25.7	4.3	100.2	38.6	23.0
19.	1022-63	AC-158	1.5	24.5	4.3	90.2	37.4	22.0
20.	989-63	Pak-111	0.0	27.7	4.2	67.9	36.8	22.0
21.	1017-63	AC-306	0.0	27.9	4.2	115.1	35.4	22.0
22.	1006-63	Pak-111	2.0	11.7	4.1	90.4	35.7	22.0
23.	1005-63	Pak-111	0.0	18.5	4.0	84.2	37.6	21.0
24.	985-63	Pak-111	0.0	12.5	3.9	75.1	35.1	22.0
25.	1014-63	Pak-8	0.0	17.6	3.9	101.5	33.6	23.0
26.	1025-63	AC-275	3.7	15.6	3.6	71.0	35.6	23.0
27.	1015-63	AC-306	0.0	11.6	3.6	91.1	36.5	21.0
28.	1009-63	Pak-134	2.0	17.9	3.5	70.8	35.7	23.0
29.	1020-63	AC-111	0.0	16.7	3.5	72.4	34.7	22.0
30.	997-63	Pak-111	0.0	22.5	3.4	73.4	35.2	22.0
31.	1001-63	Pak-111	0.0	13.5	3.4	80.4	41.4	22.0
32.	1003-63	Pak-111	2.5	12.9	3.3	76.0	34.8	23.0
33.	1016-63	AC-306	0.0	12.5	3.3	70.3	36.7	23.0
34.	Pak-111	Standard	0.0	18.5	3.2	82.9	35.5	24.0
35.	AC-134	Standard	0.0	22.2	3.2	71.2	33.9	24.0
36.	988-63	Pak-111	0.0	18.5	3.0	74.5	36.6	23.0
37.	1019-63	AC-134	0.0	23.3	2.8	79.3	35.5	22.0
39.	999-63	Pak-111	1.5	31.6	2.6	88.2	34.2	22.0
40.	1000-63	Pak-111	0.0	18.5	2.3	49.7	35.0	22.0
41.	998-63	Pak-111	0.0	26.6	2.1	67.5	35.0	23.0
42.	1010-63	Pak-111	0.0	21.4	2.0	66.1	44.9	21.0
43.	991-63	Pak-111	1.5	12.5	1.9	75.4	34.4	23.0
44.	993-63	Pak-111	3.5	13.5	1.7	63.2	34.1	22.0
45.	994-63	Pak-111	2.5	13.5	1.7	63.2	34.1	22.0
46.	995-63	Pak-111	0.0	24.5	1.7	76.3	34.6	23.0
47.	992-63	Pak-111	3.7	18.9	1.6	81.0	34.4	22.0

was comparatively higher than L.S.S. and Pak-111 in 1962-63 and AC-307, AC-134 and Pak-111 recorded less foreign matter than L.S.S. during 1963-64. Pak-111 was, therefore, superior to L.S.S. and other standard types in foreign matter content. Pak-111 showed slight indications of superiority over L.S.S. and other standards in shedding of burs; whereas Pak-111 recorded the highest percentage of shedding of bracts out of all standards followed by AC-307 and L.S.S. in 1962-63; and no standard type was found superior to L.S.S. in this respect in 1963-64.

The performance of the breeding material showed definite improvement as quite a number of families showed low foreign matter content; high shedding of bracts, high yield, ginning outturn and comparable or better staple.

Discussion

The results presented in this paper are briefly discussed here:

The size of burs and bracts was found to be large in general as shown in Appendices I and II and only in few cases it was medium during both the years. Small bracts were noted only in 4 cases during the year 1963-64. The percentage of shedding of burs was 0.0 to 3.5 in the first year and 0.0 to 3.7 in the second year. Similarly shedding of bracts was 8.5 to 35.7 percent during 1962-63 and 9.5 to 31.6 during 1963-64.

Such a vast range of values of shedding percentage i.e. 0.0 to 29.8 for burs and bracts during 1962-63 and 0.0 and 25.9 per cent during the

year 1963-64 show considerable scope for improvement of grades by breeding types with higher shedding percentage for burs and bracts; as has been suggested by Harrison⁹ Brown¹³ and Khan and Stroman¹⁴ and discussed in great details by Bur. Agri. Econ.¹

A close study of Appendix III pertaining to lint colour in the entire breeding matter for both the years 1962-63 and 1963-64 has proved that under the conditions prevailing in Lyallpur area, where hand picking is invariably done and pickers are in general more careful for quality of kapas picked than pickers of other areas, the grade colour of lint is white, although slight variations do occur on account of longer exposure of opened bolls to environmental effects such as wind, storms, dew, frost etc. Greater damage to lint was, however, reported by Bur. Agri. Econ.¹ and Hancock² Barker and Berkley⁵ Dick,⁶ Gerdes.⁸ The varietal differences, however, play an important part in colour grades and the existing variations although slight show indications for further improvements by selection etc. as already shown by Harrison^{5b}

The data relating to foreign matter content during the years 1962-63 and 1963-64 as given in Appendices IV and V clearly show scope for considerable improvement by selection for reducing the foreign matter content. The range of foreign matter content was 0.68 to 6.11 grams per plant during 1963-64 as compared to 3.4 and 5.7 grams for L.S.S., 3.4 and 3.2 g. for Pak-111, 4.5 and 3.2 grams for AC-134 and 4.6 and 5.4 grams for AC-307 during the first and second year respectively.

The foreign matter content is considered to be more in hairy varieties which may have leaves sticking for longer periods and burs and bracts may be adhering to the plants indefinitely. Varieties with non-hairy leaves, and small bracts shedding before picking can help in solving the problem of high foreign matter very easily. The programme under investigations has, therefore, clearly shown that breeding of varieties, shedding leaves before picking will help in reducing foreign matter content appreciably, whereas Bur. Agri. Econ.¹ Dick⁶, Harrison^{5b} Dunnam and Clark^{3a} Gerdes,⁸ Henderson *et al*¹⁰ Khan and Stroman,^{5,16} and Lund and Meyer¹⁷ have already discussed foreign matter and grades and desirability of having better types for this purpose.

The consolidated statements of all characters given in Appendices VI and VII have shown beyond doubt that the breeding material under study during they years 1962-63 and 1963-64 had very wide range of high shedding percentage and low foreign matter and these characters were

combined with high yield, ginning outturn and staple length in a fairly large number of families, indicating a bright future for the present programme of improvement in cotton grades through breeding of cotton varieties shedding leaves before first picking.

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