https://doi.org/10.29321/MAJ.10.A01388

Mungari Cotton Strain 274

By

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Introduction :—Mungari cottons form a part of cottons generally known as "Westerns" which is a trade term applied to cottons grown in Bellary District and adjacent Gooty taluk of Anantapur District and Pattikonda taluk of Kurnool District. This cotton, though graded as second class cotton due to shortness of its staple and uncertainty in yield owing to any precariousness of the season, is of no little importance to cotton market as it covers a huge area of nearly 1,150,000 acres. It is grown both on black and red soils, major portion however, being grown on black and loamy soils. It consists mainly of Gossypium Herbaceum but there are traces of Indicums and Neglectums, the latter have, however, spread in recent years with giant strides forming nearly 50 per cent of the bulk crop on red soils. They were first introduced in Adoni somewhere about 1900 but their extensive adoption dates from about 1916—17 and from this date these types were a serious rival to local cottons on red and mixed soils. Further, due to their heavy outturn they gain high commendations from the ryots whose main craving is quantity and not quality. In addition to this they are grown with less rainfall and also on lighter soils than the variety of Gossypium Herbaceums formerly grown. These types have become so prominent, that due to the vagaries of the season they also entered the arena of black soils and the discovery of a type which can compete successfully with these Neglectum varieties was, therefore, an important problem for the Department and to attain this end selection work was started in Mungari (or early cottons) and the strain M. 274 possessing several combinations was evolved.

The object of this paper is to give an account of the work done at the Hagari Experimental Station during the last six years in investigating the characters of various types of Mungari cottons as they occur in the tract and in isolating and developing types which might meet the needs of the grower and spinner alike. It is quite essential in the beginning to have a general idea of characteristics of various constituents of the Mungari local crop before dealing with the methods adopted in isolating the pure strain M. 274.

Paper which secured the Ramasastrulu-Munagala Prize.

The local Mungari which is mainly sown on red and light soils during the early season (between 15th and 30th of June) is a mixture of various types. It consists mainly of Neglectum, Indicum and Herbaceum types and their crosses together with a little sprinkling of American Dharwar (Gossypium Hirsutum). White and yellow-flower-Neglectums and their crosses with other types of cotton form nearly 75 per cent. of the local crop and of the remaining, Indicums form 30 per cent., Herbaceums 45 per cent and American Dharwar 5 per cent. Of the Neglectum types, Neglectum Roseum, the white flowered variety, is the one most liked by the cultivators on account of its high yield of kappas and high ginning percentage and it forms nearly 40 per cent of the crop, and the other types of neglectums, Neglectum Malvense and Neglectum Verum form only a small proportion due often to their low ginning percentage. The detailed Botanical descriptions of these Neglectum types is beyond the scope of this paper but their main characters are given here for the purpose of distinguishing one type from the other. Neglectum Malvense, the best of the Neglectum types, from the commercial point of view has broad lobed leaves with yellow flowers, having length of staple varying from 6/8 to 7/8 of an inch, possessing, however, a low ginning outturn of 25 per cent Neglectum Verum which is second in rank is easily distinguishable from its narrow lobed leaves with yellow flowers. The length of its staple is 5/8 to 6/8 of an inch, but its ginning percentage is about 30. Neglectum Roseum, the last and worst of the types from the spinners' point is conspicuous with its white flowers and low length of staple 4/8 to 5/8 of an inch and with ginning percentage as high as 40. The other types in the mixture i.e., Indicums and Herbaceums are common types of the tract. Herbaceums can be easily recognised from their bushy nature having green stem and branches in their early stages with conspicuous black dots. They are also covered with densely spreading hairs. The length of staple is nearly 7/8 of an inch with about 25 to 27 per cent. ginning outturn. Indicums on the other hand are distinct with their reddish tint throughout with bilateral monopodial branches possessing three or occasionally five-lobed leaves. Cotton is scanty, staple silky and long nearly one inch, ginning percentage, however, low, being 23 to 25 per cent.

The crosses in the mixture differ from the pure types. They are as a rule more robust in their growth and resemble sometime only one parent and sometime look intermediate of the two parents.

The latter group can be easily distinguished by its appearance and the former requires a trained eye to distinguish it and some times it is impossible to find it out from its mere appearance and it can be known only from the nature of its progeny.

The above short description clearly shows the range of variation in characters among various types in the local crop. Methodical selection work is bound to result in the discovery of a type of fixed crosses suited to this locality. The work was started in 1921—22 at the Hagari Experimental Station with the idea of isolating a Homozygous type to replace the above Heterozygous mixture. The isolation of types by means of single plant cultures was the simple method adopted in evolving suitable types. Five hundred single plants were selected during the first year at random from a local mixed crop sown with seeds obtained from the typical Mungari tract. These plants were selfed against cross fertilisation. The important vegetative characters were studied and regular descriptions and notes on several characters were taken to compare them with their progeny. Kappas was picked from each plant separately and it was examined in the laboratory for lint and seed characters. All the plants looked like crosses and also those whose characters were not up to the standard were given up. There were in fact only 22 plants possessing desirable combinations of characters i. e. high yield, high ginning percentage and long staple which were the qualities aimed at. These 32 single plants were retained for further examination and all the rest were discarded.

Seeds of each of these 22 plants were sown in separate plots in the following season 1922-23 and the individual plants were examined both for field and laboratory characters. The methods of examination were similar to those of the previous season and in addition regular records were maintained for each selection. The results of final tabulation of all characters showed that of the 22 selections only five-viz. 171, 274, 406, 408 and 440-were found to satisfy the required conditions and fit for further trial. Hence one plant from each of 274 and 406 and two from each of the remaining selections were selected and sown in 1923–24. It is during this season that the systematic study of all characters was commenced. The main vegetative characters were observed in the field and the most important of them were (i) the variation in the number of nodes at which first sympodial arises, (ii) first flowering dates and flowering record, (iii) leaf factor, (iv) the average number of locks per boll and (v) presence or absence of glands.

Similarly the important laboratory characters were examined and the variations in the following were noted :—(i) The length of staple, (ii) Lint weight, (iii) Seed weight and (iv) Average number of ovules and seeds per lock.

The results of the third generation proved that of the five types only three viz, 274, 406 and 171 were true to their parent type and the rest were found to split. M. 274 was the most promising and had all desirable combination of characters, their variations being confined to only narrow limits. It was, therefore proposed to sow the seeds of this type on a small plot. The selfed seeds of all plants were accordingly mixed and sown in a separate plot of 60 cents for yield test. Two single plant selections were also made to be sown in separate plots for further confirmation of results.

M. 406 was also isolated but had very low lint weight, though it had longer staple and therefore it was unnecessary to sow its seed on a big plot.

M. 171 and M. 408 were discarded as they were inferior to M. 274.

M. 440, a Heterozygous type, had good combination of characters and with the hope of isolating a type from this three single plants were selected for sowing during the following season.

Thus six plants, two from M. 274, one from M. 406 and three from M. 440 were sown in separate plots during the season 1924—25. The field and labouratory characters were examined as usual. M. 274, M. 406 and also the three plants of M. 440 were found to be true to type. Of the three selections of M. 440, two were below the standard type aimed at and were therefore given up. Five plants in all, three from M. 274, and one from each of M. 406 and M. 440 (the selection retained) were selected and sown in separate plots in 1925—26.

Besides the single plant selections, the pure seed of M. 274 was sown for yield tests on an area of 2½ acres. The high yield of 1253 lb of kappas per acre during the previous season gave high hopes of this strain and for want of typical soil in this station for this cotton, the seeds of this strain were distributed to different district centres for trial in various types of soil. The crops in all the centres grew well during the early stages but due to the vicissitudes of the season the strain suffered a great

deal and recorded very low yields except in Adoni and Bellary taluks where more than average yields were recorded. The station yields were, however, better i. e., 717 lb per acre, though less than the previous year's average. The results of the study of the character of the strain once again showed the purity of the strain for all the important characters though due to abnormal conditions of weather, certain fluctuations were observed in many of the characters during the season especially in length of staple and lint and seed weights. These fluctuations were but common when quantitative characters are considered and though the observations conclusively proved the purity of the strain, yet another season's trial was considered necessary and single plants were again selected for detailed study during 1926–27. Similar selections were also made in M. 406 and M. 440. In all the five plants, two from M. 274, and one from M. 440 were sown in separate plots during the season 1926–27. The observations recorded during this season further corroborated the results of the previous seasons, thereby establishing the purity of the strain and its undoubted superiority over all the other strains.

During this season comparative trials of this strain with local *mungari* were also tried but the results are not conclusive due to soil variations. The regular trials will be started during the next season on typical soils in district centres.

The above brief history shows how this strain M. 274 came into existence and it is quite essential to describe below its important characters.

1. *First Sympodial*:—This is an important character which is responsible for early and late flowering types in cotton. The fruiting branches coming from the central stalk are in all cottons most productive, flowering first. The limbs and the axilaries prolong the period and their extensive devolpment very often causes the suppression of the fruiting branches in which case the flowering also starts late. Hence a desirable type is one which produces the first sympode at the earliest node possible and this strain is an ideal one in that respect having only three to four monopodials at the bottom. The average for the last five seasons is eight, and the frequency arrays (vide Table I.) will show that this character is the least variable in this strain.

2. *Leaf Factor*:—The shape of leaf is a very important character in classifying cottons and hence a detailed study of leaf

was made in our strain. Leake's method was adopted in measuring the variations in this character. It consists in the maximum length of the leaf from the tip of the central lobe, to the base of the petiole, minus the distance from the bottom of the adjoining indentation to the base of the petiole, divided by the maximum breadth of the central lobe. It is indicated in fact by the expression $a-b-c$ where a represents the maximum length of the central lobe. b the radius and c the maximum breadth of the central lobe. Precautions are, however, necessary in case of measurement as a primary leaf on the main stem differs much from the secondary leaf on the branches of the same plant. The primary leaves on any one plant vary very little with the exception of the first three and hence to secure uniformity all measurements are taken from leaf commencing from the sixth node and six leaves were measured for each plant. The average of these six leaves was taken as the average for the plant. The frequency arrays of this character (vide Table II) for strain M. 274 will show the variations in this character. The fluctuations noted in the frequency arrays of various years are mainly due to environmental factors and modes of arrays taken separately are all normal.

3. *The flower character*:—The two important aspects of these were studied in this strain, (I) The variation in the first flowering dates and (II) flowering record.

(I) The appearance of the first flower is mainly dependent upon environmental factors and variations in first sympode as already stated. The first flower appears very early in strain M. 274 and in normal seasons they appear in about 66 days. The average of the last five seasons below will confirm the statement.

Year.	Average number of days for first flower.
1922—23	95 days.
1923—24	67 days.
1924—25	64 days.
1925—26	67 days.
1926—27	67 days.

(II) The seasonal distribution of flowers is an important factor in a strain. It is not enough that it produces maximum number of flowers but its distribution should be uniform. The actual flowering in this strain lasts for 16 to 20 weeks approximately i. e. from September to January. The period of flowering is different in different seasons owing to variable weather conditions. The table (vide Table No. III.) shows such variations in this strain, the figures representing average number of flowers perweek. From the curves it is evident that the distribution of flowers in all seasons except 1925—26 is fairly uniform and ideal. The season 1925—26 was an abnormal one. There were frequent showers during the blossom period which were responsible for such fluctuations and also for the prolongation of the flowering period till February i. e. 24 weeks

4. *Boll characters*:—The three chief characters of the boll are its diameter, the length and the number of loculi. The first two characters were determined from four well grown bolls per plant measured with callipers. These characters were also subject to variations like others, not only on different plants but on the same individual and hence utmost care was taken in selecting the bolls for measurement. The frequency arrays detailed (vide Table IV) show the variations in this character.

The other character viz. average number of loculi per boll was determined by describing about 50 to 80 bolls in each plant. The number of locks per boll varies from three to five in this strain and variation is slight, nearly all the bolls examined contained three locks. The table (vide Table V) shows the variation in this character during the last four seasons.

5. *Seed Weight*:—This is an important character of cottons as it has a bearing on the yield and the ginning percentage. Samples of 100 seeds were taken from each plant for study in the variation of this character. The variations were wide in this case and causes of this fluctuation are many and it is beyond the scope of this paper to enumerate them. Suffice it to say that weather conditions control this character. The range of variation in this character is seen from the table (Table No. VI) where frequency arrays of five seasons have been given.

6. *Lint Weight*:—The fluctuation in lint weight seems to be proportionately less than that in seed weight. The variability is, however, greater than what has generally been realised but the

frequency arrays (appendix vide table VII) clearly go to prove that the strain with a higher amount of lint weight maintains its relative position in different years.

7. *Lint Length* :—The variation in this character was found out by measuring five combed seeds from each plant. Very slight fluctuations are observed in this case. The frequency arrays of five seasons (vide appendix Table VIII) confirm this fact. The average length of staple is 25 m. m. which is distinctly higher than the ordinary *mungari* local crop (20 m. m.) and its strength is also good. The staple is also uniform and the table (vide appendix Table IX) shows the percentage distribution of various fibres in the strain.

8. *Yield*:—This is the most important of all the characters in cotton and the type of cotton best suited for a tract is greatly determined by the yield and this plays an important part in the isolation of a desirable type. The part which directly yields cotton is the boll and cotton plants vary very widely as regards their number of bolls. But the variations though intrinsic are greatly controlled by external influences. Individuals enjoying a slight advantage of plant food, moisture or space by virtue of their position bear a greater number of bolls than their neighbours, less favourably located and hence number of bolls is not the limiting factor and yield trials should be made to test this particular character. The following table shows the acre yields of this strain with the ginning percentages for the last three seasons :—

Seasons.	Yield per acre.	Ginning. %
1924—25	1,253 lb.	30·0
1925—26	717 lb.	26·0
1926—27	685 lb.	30·5

The above results are a clear proof of the superiority of the strain over local *Mungari* but to have a final say, spinning qualities of the strain are essential. Hence samples of lint of the strain were submitted to the Director of Technological Laboratory, Indian Central Cotton Committee, Bombay for complete tests. The results of last two seasons are very encouraging. He observes as follows :—

"Comparing sample No 63 (M. 274) with sample No. 64 (Mungari Local) we note that the selection M. 274 spins much better than the local cottons. The upper limit to which M. 274 may be spun as warp yarn with moderate twist is about 20s, while Local Mungari cannot be spun satisfactory above 10s."

Thus we have a strain which yields better, gins higher and possesses a staple which is longer and stronger than the ordinary Mungari Local.

Description of M. 274 :—A tall erect plant with two to four well developed monopodials at the bottom and well developed sympodes afterwards, these becoming successively shorter upwards. Generally plants grow to a height of 6 to 8 feet and it is a fixed Neglectum Indicum cross and may be broadly classed under main head Indicum.

Stem :—Tall, robust, simple, tapering gradually from bottom to apex, basal branches long ascending, medial, moderately long, uppermost small. Internodes short, all branches ascending almost acutely (40—60°) to the main stem.

Branches :—Pinkish red (purple) with close very short stellate hairs, mixed with longer, simple pilose hairs. There may be 2 to 4 well developed monopodials and about 30 sympodial branches. The main monopodials, later in the season develop in turn secondary and tertiary branches, monopodes and sympodes.

Leaves :—Simple, alternate, stipules two, one on each side, linear, lanceolar acuminate, hairy at the margin with reddish tint at the terminal point.

Petiole :—($1\frac{1}{2}$ to 2 inches) Sparsingly hairy and coloured just as the branches.

Leaves :—Dark green in colour with a distinct red blotch at the base where it joins petiole, mid-ribs distinct (central one very frequently purple coloured), 3 to 4 lobed, base cordate, lobes broadly ovate and obtuse entire, obtuse angled, pubescent at the upper, sparsingly hairy at the bottom and margins. Nectaries absent on the veins at the back of the leaf.

Flowers :— Solitary, terminal, bisexual two bracts, keel shapied and slightly dentate, one slightly bigger and more consipciuous than the other.

Peduncle: Short ($\frac{1}{2}$ to $1\frac{1}{2}''$), the portion above the joint is trigonus.

Bracteoles: Three, jointed at the bottom forming an epicalyx broadly ovate triangular, acute, entire or toothed only at the apex, two to four teeth, teeth small, mucronate and hairy at the margins. Conspicuous reddish tint on the upper surface and at the middle of the base. Venation longitudinally sub parallel

Calyx:—Gamosepalous, cupular, limb almost entire, occasionally wavy, nectaries at the base absent, accrescent and usually splitting in fruit.

Corolla:—Petals five, free contorted, adnate to each other at the base and also to the androceum. Deep yellow in colour with dark scarlet pinkish eye.

Stamens:—Indefinite, monodelphous, forming into a tube round the gynaceum almost coming to the top of the petal, anthers kidney shaped, deep yellow in colour.

Filaments:—Single or branched, divergent at the base and inclined upwards towards the top, deep red in colour, in a few cases rosy higher up the column.

Style and stigma:—Intermediate, slender, rounded, differentiated into 3 to 4 stigmatic branches, grooved, without any black dots.

Ovary:—Superior, syncarpes, 3 to 4 celled, ovules 9 to 11 on axile placentation.

Bolls:—Drooping, well-developed, usually 3 celled, sometimes 4 celled, rounded at the base, almost spherical, tapering tendency towards the apex, but abruptly mucronate especially 4 celled bolls. Surface slightly pitted opening fully when ripe, valves strongly reflexed so that cotton becomes pendulous and drops off easily

Cotton:—Profuse, somewhat rough, curly, little less than an inch in length, pure white, seeds 7 to 8 per lock, well developed covered with velvet greenish grey fuzz and spiny hilum, rounded at the base and taper into a short point. Seeds well filled up and hard.

Acknowledgment:—I am very much indebted to Messrs. P. H. Rama Reddi, R. C. Broadfoot and G. R. Hilson for the facilities given in carrying out the above work and for valuable advice and suggestions made from time to time. My thanks are also due to Mr. K. R. Ramamoorthy Ayyar for the paintings and photos of the various parts of the plant.

APPENDIX.

TABLE I.

Frequency arrays.

Nodes.	1922–23	1923–24	1924–25	1925–26	1926–27
5	...	1	21	...	1
6	1	3	55	31	24
7	4	18	164	103	59
8	9	52	255	256	91
9	5	81	227	103	18
10	4	31	95	23	6
11	1	20	8	3	1
Total.	24	206	825	519	200
Average.	8	9	8	8	8

TABLE II.

Years.

Leaf Factor.	1923–24	1924–25	1925–26	1926–27
1·3	1	...	...	...
1·4	5	...	...	4
1·5	15	...	...	5
1·6	57	...	1	18
1·7	64	1	11	28
1·8	50	5	16	47
1·9	23	54	30	59
2·0	4	112	62	27
2·1	...	109	31	6
2·2	...	35	7	2
2·3	...	7	2	...
2·4	...	2	...	...
Total.	219	325	159	196
Average.	1·7	2·0	2·0	1·8

TABLE III.

Flowering Curves.

Mungari Strain 274.

August.		September.				October.				November.			
3rd	4th	1	2	3	4	1	2	3	4	1	2	3	4
						1923—24							
...	...	0·04	0·6	2·4	5·5	8·1	10·1	13·1	13·3	10·5	7·6	5·3	2·4
						1924—25							
...	...	2·4	5·0	7·9	8·9	13·0	13·7	14·7	13·3	10·3	9·5	4·4	4·3
						1925—26							
...	...	0·002	0·4	3·1	5·0	5·9	8·1	10·0	10·4	6·3	4·7	4·4	7·9
						1926—27							
0·72	2·55	3·47	3·53	3·06	1·74	1·65	1·89	1·27	0·99	1·06	0·74	0·74	0·58

TABLE III (Continued).

December.				January.				February.			
1	2	3	4	1	2	3	4	1	2	3	4
				1923—24							
0·6	0·26	0·2	0·2	...	0·06	0·18	0·5	1·06	2·2	2·8	0·8
				1924—25							
7·2	2·8	1·5	0·5	0·7	1·0	0·8	0·8	...	...	...	...
				1925—26							
9·0	7·6	4·7	4·5	5·0	4·3	6·5	9·2	10·3	14·4	12·0	8·7
				1926—27							
0·33	0·51	0·70	0·47	...	...	...	...	...	...	...	...

TABLE IV.

Frequency arrays.

M. M.	1924—25.	1925—26.	1926—27.
29	3	8	5
30	30	26	22
31	66	55	41
32	12	49	45
33	61	22	38
34	22	10	21
35	6	4	2
Total.	300	174	174
Average.	32 m. m.	32 m. m.	32 m. m.
19	..	...	1
20	...	2	19
21	1	26	35
22	10	60	69
23	30	52	43
24	79	29	7
25	134	5	...
26	44	...	...
27	2	...	...
Total.	300	174	174
Average.	25 m. m.	23 m. m.	22 m. m.

TABLE V.

Average Number of locks per boll.	Frequency arrays.			
	1923–24	1924–25	1925–26	1926–27.
3·0	20	13	55	61
3·1	54	78	64	50
3·2	79	164	59	30
3·3	39	105	16	17
3·4	13	49	6	4
3·5	3	10	...	1
3·6	1	1	...	1
Total.	209	420	200	164
Average.	3·2	3·2	3·2	3·1

TABLE VI.

Frequency arrays.

M. G.	1922–23	1923–24	1924–25	1925–26	1926–2
46	1	...	...	...	...
47	1	...	...	...	...
48	1	...	...	...	...
49	2	...	...	...	...
50	...	...	...	5	...
51	5	3	...	1	...
52	2	1	1	4	2
53	2	2	2	3	...
54	...	1	3	2	...
55	...	5	10	4	1
56	1	10	5	7	3
57	...	9	7	6	1
58	1	13	15	10	...
59	...	6	23	7	3
60	3	28	30	17	...
61	...	19	38	16	4
62	...	26	39	22	4
63	...	24	56	28	1
64	...	17	50	23	9
65	...	27	72	16	9
66	...	13	77	30	11
67	...	4	79	15	9
68	...	6	69	12	9
69	...	4	57	4	2
70	...	...	46	3	6
71	...	1	33	...	4
72	...	...	30	...	5
73	...	...	20	...	2
75	...	...	14	...	1
76	...	...	13	...	...
Total.	19	219	789	235	86
Average.	54	62	66	63	66
Standard Division.	...	3·8	3.56	4.5	4·79
Probable Error.	...	4·0%	4.8%	4·7%	4·9%
Coefficient of variability.	Nil.	6·1	5·6	7·14	7.26

TABLE. VII.

Frequency arrays.

M. G.	1922–23.	1923–24	1924–25	1925–26	1126–27
19	1	...	...	...	...
20	3	1	...	10	...
21	4	1	...	6	...
22	5	5	1	5	...
23	3	7	...	16	...
24	2	14	9	22	2
25	1	21	11	33	8
26	1	32	40	33	5
27	...	43	60	38	5
28	...	38	22	37	19
29	...	32	27	18	22
30	...	15	44	15	19
31	...	6	27	3	3
32	...	4	97	...	1
33	...	...	41	...	3
34	...	...	15	...	...
35	...	...	1	...	...
36	...	...	2	...	...
Total.	20	219	797	36	87
Average.	22	27	30	27	38
Standard Deviation.	...	2·21	2·08	2·78	1·99
Probable Error.	...	5·4%	4·5%	5·0%	4·6%
Coefficient of variability.	...	8·2	6·7	10·9	7·1

Table VIII

Frequency arrays.

M. M.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27
20	2	...	...	...	...
21	3	...	...	...	...
22	7	2	3	7	1
23	6	15	48	45	14
24	3	66	213	139	41
25	...	94	349	140	77
26	...	42	148	39	26
27	...	...	43	7	5
28	...	...	4	...	2
Total.	21	219	808	370	166
Average.	23	25	25	25	25
Standard Deviation.	...	0.88	1.07	1.09	1.01
Probable Error	...	2·4%	2·3%	2·9%	2·72%
Coefficient of variability	Nil.	3.5	4.2	4.3	4.04

Table IX.

Fibre length distribution. (Balls sorter).

Main group length in eighth of an inch.	1924–25	1925–26.
2	...	0.9%
3	1.0%	2.0%
4	2.3%	4.2%
5	5.8%	10.0%
6	13.8%	26.4%
7	32.4%	43.6%
8	32.4%	11.0%
9	10.6%	1.9%
10	1.†%	...