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A Note on Hagari Cottons.

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The most important item of agricultural improvement which has been successfully attempted by the Madras Agricultural Department in the Bellary District, is the improvement of local cottons of indigenous origin. These were found to be for the most part of poor yielding capacity and of low ginning percentage, while the lint was fairly rough and short. The problem, at first, was to find out a type of cotton better adapted to the needs of the grower and the spinner alike. With this end in view, the department carried out at the Hagari Experimental Station, near Bellary, a series of trials on both exotic and extra-provincial types of cotton for about four to five seasons from 1907. Egyptian, Afghan, Broach, Surat and Kumpta were the important ones that were tried here. Due to one reason or other, the attempt at acclimatization of exotic and extra-provincial varieties ended in a failure. As a result of this experience and knowledge, it was decided to concentrate effort upon the improvement of the existing indigenous varieties for the production of a long stapled cotton, suitable to the black cotton soils of the Bellary district.

Selection and hybridization are the two methods, generally employed by Scientists, to improve the quantity and the quality of the produce of plants. With a view to get immediate results of considerable economic importance, the former method was employed at the Hagari Experimental Station to isolate a Homozygous type with superior qualities of lint, from the Hetrozygous mixture of local cotton. The first attempt in selection work on Hingari or late-sown local cotton, which is commonly termed "javari pathi" in Telugu, was made in the year 1908-09 and it consisted in raising pure lines, in making a comparative study of the selected types of plants and in eliminating inferior types till only a small number of promising types remained, from which a final selection was made for comparative trials with the local cotton. As a result of

careful and diligent search, many types of cotton were, within a short period of time, evolved for distribution to ryots.

A beginning was made in the year 1912-13 by the distribution of Hagari types 1 and 2, which except for the purity of seed, were in no way decidedly better than locals. These were later on replaced by the types of Hagari 43 and Bellary 5. These too had their own draw-backs. The former had a longer staple with a better quality of lint than locals, but it, being a low ginner, was not popular with the tillers of the soil. The latter (Bellary 5) possessing a good yielding capacity and a high ginning percentage became the favourite of the cultivating class, but it, being a short stapled variety found no favour with the spinner. It was in the year 1917–18 what a really good material in the shape of Hagari 25 was developed by selection to the satisfaction of both the grower and the spinner.

This improved strain of Hagari 25, commonly termed as Farm or Sircar Cotton, is now very popular among the agriculturists of this tract Its superiority over locals consists in the quantity and the quality of the produce. The yield of this improved strain is higher than locals by about 38% and the percentage of lint to seed-cotton by about 2%. Its staple is nearly an inch in length and fairly uniform. The fibres are pretty strong and can be easily detached from the seed, a good asset from the ginner's view-point. The pure white colour of its lint has got a magnetic attraction in the cotton market. In addition to these, the early and uniform maturity of the cotton with its facility for easy gathering of kapas from burst bolls and its better drought resisting nature than locals and the ready willingness of the buyers to purchase this cotton at a premium, make this strain a real favourite of the peasantry of the regada soils.

Further work in selection has resulted in the evolution of a better strain viz., Hagari 62 (which is renamed as Hagari 1) than Hagari 25. A brief review of the methods adopted in its evolution at the Hagari Experimental Station, is given below.

Hagari 1 is a pure strain, isolated by means of single plant cultures, the most simple method in plant breeding. Five hundred single plants were in 1920–21, selected at random from a bulk field of Hagari 25. They were selfed against cross fertilisation. Individual pickings were done. A good many of the plants among them were discarded by empirical examination of lint and only the few plants, possessing very fine lint, were examined for lint-length and lint and seed weights. Only three plants viz., Hagari 25 (a), Hagari 25 (b) and Hagari 25 (c), withstood the test and were the best of the lot. Individuals of Hagari 25 (c) were sown in a separate plot in the following season 1921-22. Variations in vegetative characters were studied in the field and they were examined in the laboratory for the important lint and seed characters. The results of the laboratory examination were very encouraging. The plant Hagari 62 (which is now renamed as Hagari 1), was the most promising and had 30.80 ginning percentage. It was therefore decided to scrutinize this selection from all aspects. All its selfed seeds were sown in separate plot in the year 1922-23 for further trial. The plants of this selection were examined in detail in the field and in the laboratory for all the important vegetative and laboratory characters respectively; and in fact, regular and systematic work was commenced. It was gratifying to note that in the third generation the selection was pure to the majority of characters, frequency arrays of the important characters were normal and in all cases, the modes coincided with the means. This strain was not only pure to the economic characters but also superior to Hagari 25 in its lint and seed weights. It was therefore considered advisable to test this strain for yield. A small plot was sown with the selfed seeds during the year 1923–24 to get a sufficient quantity of seed for conducting comparative trials in the following season. The plot yielded 340 lbs. of seed-cotton per acre. For corroboration of the results of the previous seasons, two single plants were also selected. The field and the laboratory characters proved once again the purity of the strain.

The strain Hagari 1, being superior to Hagari 25 in the three most important characters, was compared with the strain Hagari 25 and local cotton during the season

1924–25. The results of the comparative trials were positive, the difference in favour of Hagari 1 over Hagari 25, being 2.6 times the probable error. The yield of Hagari 1 in the bulk plot was 501 lb per acre on 1.90 acres against 207 lb of Hagari 25, the highest yield in the latter being 310½ lb per acre on 2·80 acres. Comparative trials of Hagari 1 and Hagari 25 were continued in the following seasons, viz., 1925–26, 1926–27 and 1927–28, to eliminate the effect due to seasonal variations. The comparative trial results of all these years showed that Hagari 1 was decidedly a better yielder than Hagari 25 as shown below:—

Season.	Average yield in ounces H. 1	H. 25	Perecntage of increase in the yield of H. 1. over H. 25.	No. of times of increase over the probable error in favour of H. 1.
1924–25	49	44	11·40	2 60
1925–26	62	56	10·70	4·20
1926–27	86	80	7·83	4·16
1927–28	102	90	13·30	4·28

The above figures in combination with the figures given in the Table below, clearly prove the superiority of the strain Hagari 25.

Maximum Yields and Ginning percentage of strains Hagari 1 and 25 for five seasons.

Season.	Hagri 1.		Hagari 25.	
	Yield in lbs.	Ginning %	Yield in lbs.	Ginning %
1923-24	340	30.00	....	crop failure.
1924-25	613	27.00	207	23.00
1925-26	335	26.70	195	23.50
1926-27	377	29.40	239	25.30
1927-28	520	28.92	311	25.63

H. 1 cotton has successively shown its superiority over H. 25 cotton in yield and ginning percentage, while the quality of the lint of the two strains is the same. The Director of Technological laboratory of the Indian Central Cotton Committee, Bombay, to whom the lint of these two strains were sent for spinning tests, reports thus :—"There is practically no difference between the two Hagari cottons (Hagari 62 and Hagari 25), the slightly higher strength results obtained for Hagari 62 being associated with rather higher actual twists. Both are suitable for warp yarn of moderate twists up to 30s." In short, Hagari 1 cotton is an improvement over the old popular strain Hagari 25 and is better than it by about 15% from the point of yield of lint per acre, while the commercial value of its lint is equal to that of Hagari 25 cotton. Hence, from the current season, Hagari 1 strain is being distributed to replace Hagari 25 cotton. The average characters of Hagari 1 and Hagari 25 cottons for five seasons are given in the following table.

Strain Hagari. 1.

Season.	Yield.	Length of Staple.	Seed weight.	Lint weight.	Ginning percentage.	First sympodial.	No. of days for 1st flowering.	Maturation period of bolls.
1922-23	12	26	62	28	31	10	115	...
1923-24	40	27	65	28	30	7	68	52
1924-25	30	26	53	21	29	9	100	51
1925-26	17	20	43	16	27	8	130	34
1926-27	24	25	63	27	30	8	90	48

Strain Hagari 25.

1922-23	16	24	49	16	25	9	110	...
1923-24	35	26	59	22	27	7	75	56
1924-25	25	25	51	18	26	9	106	55
1925-26	10	20	44	15	25	9	140	36
1926-27	25	25	53	30	27	9	91	49

The next stage in the "cotton Improvement" work in the Bellary centre, consists in the production of large quantities of cotton seed of the improved strain, Hagari 1,

without impairing the standard of its purity, for distribution to cultivators for whose benefit the strain has been evolved by the plant breeder. It is needless to emphasise the importance of this problem, especially in cotton, in which cross fertilisation is very common and the causes for the mixing of seed of different types and for making the strain to rapidly lose its distinctive qualities and fall to the level of the variety of cotton it is hoped to displace, are many.

As a matter of fact, much of the cotton grown in this tract, is even now raised from mixed seeds of various types creating a suitation under which the question of purity entirely disappears. The standard of improvement is permanently injured in the field, due to the natural cross fertilisation which goes on freely between the local and the improved varieties through the agency of wind and insects; and no amount of "roguing" for any number of years can bring it back to its original condition. Deterioration in such cases can only be prevented by the continuous renewal of pure seed from the original stock or by the evolution of a fresh strain. As this is more or less a recurring phenomenon, there can be no finality in selection work for building the stock of seed for multiplication.

The actual multiplication of the small stock of pure Hagari 1 cotton seed, grown on the Hagari Experimental Station, into a quantity sufficient for distribution to the farming community, is being done in this locality in what are commonly known as "Seed-Farms", which are the nucleii of the seed-distribution organisation of the agricultural department. The Agricultural Demonstrator, with the previous consent of the cultivators, selects a consolidated block in the typical black cotton soil area, suitable to the successful cultivation of Hagari 1 cotton. Compactness of the seed-farm area of cotton, in which cross fertilisation is very common, is essential, if the work of the breeder is not to be nullified. The actual cultivation of the crop is, from start to finish, carried on by the ryots themselves; but "roguing" in the seed-farm area is done under the supervision of the Demonstrator at the cost of the Departmnet

of Agriculture. The percentage of "rogues" in any one year has, so far, not exceeded more than O. 1. At the time of sowings, H. 1 cotton seed is lent to the seed-farm ryots on the condition that it should be repaid in kind after their kapas is ginned. The seed-farm ryots are farther bound by the agreement taken in writing, to sow H. 1 cotton unmixed with other cottons, to cultivate their lands clean and to attend to the clean picking and proper storage of the produce. After cotton-pickings are over, kapas is brought by them to the Government Ginning Factory at Hagari, where it is ginned under the careful snpervision of the Demonstrator. With the previous approval of the Deputy Director of Agriculture, 111 Circle, Bellary, the Demonstrator purchases this seed at a rate which is slightly above the ruling market rate. The seed of the improved strain Hagari 1, propagated on these seed-farms and purchased by the department, is then stored in the departmental seed-depots at Hagari and Bellary. This process takes place year after year, fresh seed from the seed-farms continually replacing that of tbe previous year to avoid the danger of growing hybrid seed. The acreages of seed farms located in the Bellary centre during the past seven seasons are given in the table below :—

Season.	Area under H.25 cotton in acres.	Area under H.1cotton in acres.
1922–23	500	....
1923–24	600	....
1924–25	906	....
1925–26	1,101	45
1926–27	427	1,068¾
1927–28	...	3,311
1928–28	...	2,971

The next step in the "cotton improvement" work here is the distribution of the improved seed of Hagari 1 cotton to cotton-growers. Owing to the paucity of seed merchants of proved integrity and enterprise, the distribution of this seed is almost entirely controlled by the Department of Agriculture, to prevent the sale of seed of doubtful quality

as "departmental seed". Successful attempts were, however made now and then to sell the departmental seed to the cultivators through private as well as co-operative agencies. During the current season 1,01,836¼ lbs. of H. 1 cotton seed valued at Rs. 4,736–9–0, has been sold to farmers on a cash basis through the Bellary Co-operative Loan and Sale Society limited, Bellary. Here it may be said without any fear of contradiction that the burden on the agricultural department, which the work of the seed distribution involves, has become an unduly heavy one and that the co-operative department is, at present, the only agency which can materially lighten this load which is so far borne entirely by the Department of Agriculture. The quantities of improved seeds of Hagari 1 and 25 cottons, issued to the cultivating class for sowing purposes in the Bellary centre during the past seven seasons, are given in the subjoined table:—

Season.	H. 25 cotton seed in lbs.	H. 1 cotton seed in lbs.
1922–23	84,367½	...
1923–24	1,60,116	...
1924–25	91,098	...
1925–26	77,5351/6	400
1926–27	1,24,742½	8,720
1927–28	7,047	33,429½
1928–29	...	2,22,446½

In addition to 7,047 lbs. of Hagari 25 cotton seed and 33,329½ lbs. of Hagari 1 cotton seed mentioned in the above table, 1,16,100 lbs. of Kumpta cotton seed, specially purchased by the department, were sold for sowing purposes through the Co-operative Loan and sale society, Bellary, during the season 1227–28.

The final stage in the "cotton improvement" work consists in ginning and marketing of cotton. Before entering into detail as to what the agricultural department has done in this direction, it may be well to review briefly the system in vogue, under which cotton is marketed in Bellary.

The Bellary cotton market is more or less an unorganised one, having no market committee to regulate the system of its working. Cultivators and village merchants are the two classes of sellers who bring their produce for sale to this market where it is stocked in the godowns of dalalidars who act for them on a commission basis. Though nothing prevents them from effecting direct sales in the market, they are invariably compelled to employ these dalalidars in the disposal of their produce. Due to many handicaps under which the cultivators labour in this tract, they are not free to dispose of their produce as they please. Prominent among them are heavy indebtedness, low standard of literacy, unsatisfactory communications, the absence of properly regulated market, the lack of co-operative spirit among the peasantry and to a certain extent, the unwillingness on the part of the buyers to purchase cotton in small quantities. Small cultivators with a view to avoid the dangers attending the sale of their cotton in the market, especially in regard to the loss inweighment and deductions in kind as well as in cash, against which they have no effective means of protest, prefer, however, to sell their cotton in the shape of kapas in the villages themselves to village traders who are often financed by the dalalidars at Bellary. Besides the deductions both in kind and in cash, attending on the sale of cotton in the Bellary market, which are given in the statement below large samples of produce, varying from 1.62 lbs. to 3.24 lbs. for every docra of lint and 3.24 lb. to 6.48 lbs. for every docra of kapas or unginned cotton, are taken for which the owners of the produce are not paid evenwhen no sale is effected.

Customary deductions in the Bellary Market.

	On a naga (311.04 lbs.) of unginned cotton.		On a naga (311.04 lbs.) of ginned cotton.		Remarks.
	In kind lbs.	In cash.	In kind lbs.	In cash.	
Pechu for the loss in bailing cotton.	4.87	...	4.87	...	Customary & claimed on gross weight.
Massala or sample.	...	...	0.27	...	Customary & claimed on net weight.
Allowance.	3.24 to 19.14	...	1.62 to 6.48	...	Claimed when cotton is not up to the sample or is damp etc.
Dalali or Commission*	...	4 pies per Re.	...	Rs. 2	
Weighment charges*	...	2 to 4 as. per docra	...	2 to 4 as. per docra	
Charity purposes*	...	1 to 1½ as per Rs. 100.	...	1 to 1½ as per docra	
Gorakshanas*	...	3 pies per docra.	...	6 pies per docra	
Insurance charges @	...	4 as. per 100 Rs.	...	4 as. per 100 Rs.	
Godown rent @	...	4 as. per docra.	...	4 as. per docra.	
Staking charges @	...	1 to 1½ as per docra	...	1 to 1½ as per docra	

N. B —Items marked thus *, are claimed by all dalalidars and items marked thus @, by a few.

The village traders seldom purchase the ginned cotton; but on the other hand, they buy kapas of various types, grown in different villages, and cart the same to the nearest convenient ginnery where all these different types are, in spite of the "Ginning and Pressing Factories Act," mixed so ingeniously as to defy detection by even a critical eye. The result of this vicious practice of deliberate mixing of all types before ginning, to suit their personal immediate profits, needs no elaborate telling. Suffice it to say that it causes serious admixture of foreign seed with that of the Sircar strain, resulting finally in the ruination of the quality of the latter which has been evolved and made popular by the department by overcoming many obstacles. The same method is also employed by the cotton dealers who do both buying and selling in the Bellary cotton market. The owners of the ginning factories are also responsible to a certain extent for the existence of such a state of affairs in this tract, for it is they who allow these middlemen to mix the various grades of cotton in the premises of their factories before their very eyes just before the kapas is put through the gins, using at the same time certain contrivances to increase the outturn of lint for the benefit of both. This indiscriminate mixing is, in short, due to commercial rather than agricultural conditions for which cotton-growers are not responsible.

The system of sale in the Bellary market is generally conducted by open auctions in the case of kapas or unginned cotton; but in the case of lint or ginned cotton such open auctions are not held. The buyer who is in need of ginned cotton, makes a private visit to the dalalidar's shop and strikes a bargain with the dalalidar in secret for the quality and the quantity of cotton he is in need of, when the demand for cotton is keen and the supply is less in the market. But when the market is dull and the demand for cotton is less but the supply is great, their position is reversed. The dalalidar goes to the buyer for striking a bargain with him for his clients' cotton. Any how, the produce is generally sold in the absence of the cultivator. The real price at which it sold is only known to the dalalidar and the farmer is simply to take his word. Hence there is in this system much scope for unscrupulous men to curtail the profit for the man who has produced the crop.

Grading and stapling of cotton in this locality are almost unknowu both to farmers and merchants. This is unfortunate in that the grower gets the impression that all cottons fetch approximately the same price. In other words, the slovenly grower and producer of short and dirty cotton realises the same price for his product as the grower of good cotton. The result is that no attempt is made by the growers of cotton to pick cotton clean.

So far as the seed-farm cotton is concerned, the department arranges to have the cotton ginned under its supervision and assists the cultivators in the sale of their lint in the Bellary cotton market at a premium ranging from Rs. 12 to Rs. 22 per bale of 400 lbs. lint. For the past three seasons, cotton is however sold through the co-operative Loan and Sale Society, Bellary, which came into being on 29-6-1925. Last year an attempt was made by this society to sell cotton by open auctions under the supervision of the Department of Agriculture. These auction sales were not only successful but also provided a useful means of securing to the farmers an adequate premium for the superior quality of the new strain of Hagari 1, grown by them. The following table will serve to indicate the quantity of cotton sold and the premium obtained for it during the past seven seasons.

Seasons.	Cotton sold in bales of 400 lbs.	Premium obtained on a bale of cotton of 400 lbs.	Remarks.
		Rs. A. P.	
1922–23	255	15—6—7	
1923–24	337	14—1—8	
1924–25	60	12–12–10	
1925–26	51	20—8—2	
1926–27	128	22—0—0	
1927–28	236	18—4—3 on 173 bales sold on 30–4–28	
		20—3—1 on 63 bales sold on 20–5–28.	

The difficulty in this market is that the exporting firms, both foreign and Indian, sell their cotton on types prepared by their own admixture of different varieties of high and low grades of cotton. This practice acts as a check on the onward march of the "Cotton Improvement" work of this centre. The quality of cotton, grown in this tract, is sure to improve rapidly, provided these exporting firms sell the cotton pure by its local name instead of their type numbers.

With a view to check some of the evils connected with the marketing of cotton, to maintain the reputation of the departmental strain and to secure for its producer fair weighment, fair dealing and a fair price, the Bellary Co-operative Loan and Sale Society, Ltd., Bellary, was formed on 29–6–25 by the joint efforts of the Agricultural and Co-operative departments. The area of its operation extends to two taluks of the Bellary district, viz., Bellary and Rayadrug. The membership is composed of both individuals and primary societies. Agricultural produce notably cotton, is sold for members and non-members of the cultivating class. The produce to be sold is concentrated at its head quarters, where alone sale is effected. The produce handed by the society is not bought outright by it, but sale on commission is under taken by it. The produce for sale is brought direct to the Society's rented godowns by the producers themselves. If the market happens to be dull and if the owner of the produce is in need of money, an advance, not exceeding 60 percent of the value of the produce stored in its godowns, is given to him by the Society. Cotton with the Society is graded by the Agricultural Department before it is 'sold in lots at auction sales held periodically. Grading and the sale of cotton in bulk fetched, last year, higher prices for the members' improved type of Hagari 1 cotton. Such is the history of the Society's work in brief.

Before concluding this note on Hagari cottons, I wish to review in brief the success achieved by the Department of Agriculture in its policy on the improvement and spread of improved types of cotton, evolved by the departmental cotton breeder at the Hagari Experimental Station,

near Bellary. When attempts of acclimatization of exotic and extra-provincial varieties of cotton ended in a failure, the department took to the method of selection to obtain types of cotton superior to those ordinarily grown in respect of quantity and quality. The latter attempt was crowned with success in the year 1917-18, when our popular strain, H. 25, came into existence. Since then, it is extensively cropped by the tillers of the soil. Its popularity reached its zenith during the year 1924-1925, when it covered an area of about 1,80,000 acres, representing approximately one-third of the total cotton area of the district. The giant strides made by this strain, year after year, are given in the sub-joined statement:—

Season.	Area under H-25 cotton in acres
1918—19	113
1919—20	1,794
1920—21	12,000
1921—22	12,800
1922—23	25,600
1923—24	81,100
1924—25	1,79,570
1925—26	1,67,963
1926—27	1,45,286
1927—28	1,19,232

It may be exaggerating too much to describe only the good points of this popular strain without touching on its disadvantages, which are fortunately not many. The only one which is worth mentioning here is its low ginning percentage The popularity of this strain gave, however, a great impetus for further selections to eliminate this factor also. Hagari 62, which is now designated as Hagari 1, with a higher ginning percentage than the old strain Hagari 25, was isolated in the year 1921 to 1922. After sub-mitting it to severe tests on the Hagari Experimental Station for a period of seven years, it was, for the first time, allowed to enter the arena of competition with the old but popular strain, Hagari 25, in the year 1928–1929, with a view to replace the latter strain with redoubled popularity ere long, for the recently evolved strain of

Hagari 1 is more remunerative to grow than Hagari 25 by at least 15% from the point of yield of lint per acre and it is at least equal to Hagari 25 in point of quality of lint. The acreage under Hagari 1 cotton in the current season (1928–29), is expected to be over 25,000 acres.

In fine, let me be permitted to express that the general public have begun to appreciate the intrinsic value of the departmental strains, but the time has not come to them as yet to appreciate the necessity for the classing of cotton on a rational basis.