https://doi.org/10.29321/MAJ.10.A04085

A review of the progress in the evolution of Karunganni cotton strains resulting in the release of K. 6 (Pandyan) and scope for further improvement in Madras State.

by

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Introduction : With a view to tackle the Agricultural problems of the black soil tract in the districts of Tirunelveli, Ramanathapuram and Madurai, the Agricultural Research Station at Kovilpatti was established in Tirunelveli district during 1901. Of the three major crops of this tract viz., desi cotton known in trade as "Tinnevellies and Karunganni', *Cumbu (Pennisetum typhoides)* and fodder cholam *(Sorghum dochna)*, the former which covers about 3·95 lakh acres in the tract, received foremost attention for improvement, as a cash crop of commercial value. Therefore, breeding and agronomic experiments on cotton formed an important programme of work among the various activities of the Station, since its inception. The results of the agronomic experiments have been reviewed elsewhere by Neelakantan and Guruswamy Raja (1958). The salient features of the breeding investigations carried out on this station and the progress in the evolution of improved Karunganni strains indicating scope for further improvement are summarised in this paper.

Early History of Breeding : Introduction and acclimatisation of varieties from outside with the object of replacing the local cotton were the first lines of work to start with, in cotton improvement work by breeding methods at this Station. Accordingly, a large number of varieties including extra-state, Asiatic and American types were tested for several seasons, but with negative results.

As attempts to acclimatise proved a total failure, systematic studies of the local cotton known as 'Tinnies' were taken up. The 'Tinnies' cotton is a mixture of two different botanical species viz., *G. arboreum* (Karunganni) and *G. herbaceum* (Uppam). From a systematic study of these two components of 'Tinnies' it was observed that Karunganni was the better of the two with medium staple (26/32" to 27/32"), higher ginning percent and spinning capacity of 20–30 counts. Uppam on the other hand was short stapled with 22/32" and below, coarse linted and spinning upto 14 counts. It was also observed that the former possessed greater

range of variability for effecting selection than Uppam, which was believed to be drought resistant and suited well for the late sown conditions in the tract.

Improvement in Karunganni was, therefore, first sought through 'mass selection' which aimed at collective selective or bulk selection of heavy bearing plants in the field. The results were immediate and spectacular but not lasting due to lack of combination of all the desired characters in the same plant.

Later, the more laborious and time consuming method of 'single plant selection' was resorted to, for further work. This method was adopted not only in the field bulks but also in artificially created '*inter se*' hybrid populations secured by crosses effected as given below.

1.	Uppam x Karunganni	Allogamic
2.	Karunganni x Uppam	
3.	Karunganni x Karunganni	Xenogamic
4.	Uppam x Uppam	

The above crosses were effected in 1906. Of these, only in the case of the progenies from the cross Karunganni x Karunganni a wealth variability was obtaind. In these progenies, four types of plant habits were recognised as detailed below.

Type A : An early type with no side branches but only carrying boll bearing branches (sympodials) on the main stem. It resembled *Uppam* in habit but was not productive.

Type B : Well shaped plant, freely branching with boll bearing branches on primary branches. It showed greater vigour and size of body than the ordinary Karunganni plant.

Type C : Intermediate between type A and B. It had well developed branches, chiefly from the base of the main stem. Main as well as the side branches developed boll bearing branches each carrying 5–7 bolls. Bolls came to ripening within a shorter and much more evenly.

Type D : It resembled type B, but was much larger in plant body. Late in maturity and not a desirable type for further work.

Release of Company Strains : Line selection work continued in the progenies of the above said types, resulted in the isolation of strains Company–2 (Coy–2) and Company–3 (Coy–3). The former was a C. type plant known to mature earlier than A. type to which strain Company–3 belonged. Of these, Company–3 was released for general cultivation in 1912–13 while Company–3 was released for cultivation in 1914–15. Company–3 gave higher ginning percent than Company–2. These two strains were adjudged to spin 18–20's warp counts as against 14's for 'local bulk'. Field observations showed that there was scope for further improvement by selection. But the sub-strains viz. Coy–2A and Coy–3A' developed from Coy–2 and Coy–3 respectively did not give spectacular results, as to warrant their multiplication for extension.

In 1924–25, comparative studies of the aforesaid four plant types revealed that type–A and type–C were promising for yield of *kapas*. Thus, four types viz., A–4, A–5, A–8 and A–10 from A–types and five viz., C–4, C–5, C–6, C–7 and C–8 from C–types were developed and tested for yield. The result showed that C–7 and A–10 were the best in the matter of yield with spinning capacity from 24–26's warp counts. These two new strains were first distributed in 1925–26 withdrawing the Company strains in view of the limited range of adoptability for Coy–strains. Strain C–7 was well suited for deep black soils while A–10 fared well on lighter soils. Of these, A–10 first fell out of cultivation on account of its erratic performance.

Evolution of K. 1 : In view of the limited range of adaptability for C–7 and A–10, further work was continued to evolve a cosmopolitan strain by effecting reselections in C–7. As a result, strain 2622, a reselection from C–7 was developed in 1928–29 and tested for its performance. It was an early strain resistant to drought and gave 12 percent more yield than local. The results of the district trials with this new strain along with C–7 under distribution indicated that this strain was suited to the whole of Karunganni area, excepting the eastern taluks of the tract where *Uppam* was usally sown either pure or as a mixture with Karunganni. It was, therefore, released for general cultivation, christened as K. 1 during 1934–35. It soon became very popular and spread to cover nearly 2·7 lakh acres during the years 1942–45. However, the area declained slowly in subsequent seasons and it was found to be susceptible to heavy shedding of buds and bolls, if heavy rains were received in February. It was, therefore, thought necessary to

improve upon this strain K. 1 and mitigate the above defects. The need became all the more greater in view of its rapid deterioration due to admixture and contamination with the local bulk.

Release of K. 2: As further work of reselection from strain K. 1 did not yield fruitful results for improvement, attention was directed towards breeding methods involving hybridisation, with a view to create a greater range of variability for further exploitation. Work in this direction was started by about 1934–35 and the earlier hybrid progenies of Karunganni with the extrastate arboreum types like Verum, Jarilla, Bani and a few others did not prove useful. Hence, a large number of inter-racial hybrid derivatives of *arboreum* crosses were obtained from the Madras Herbaceum Scheme, Coimbatore, during 1936–37 and vigorous selection work was persued under Kovilpatti conditions. As a result, a reselection viz., 4706 was effected in 1937–38 from culture N. 3–2/13 and isolated as a true breeding strain in 1940–41. The culture N. 3–2/13 was one derived in its turn in F_6 of a cross involving indicum 49 x (indicum N. 14 x cernuum). The new strain 4706 gave on an average 20 percent more yield and was adjudged to spin 30's warp counts as against 28's for K. 1. Besides, it was found to be more cosmopolitan than K. 1 and capable of withstanding or recovering from the ill effects of heavy untimely rains in February. It was, therefore, distributed for general cultivation in the South zone of 'Tinnies and Karunganni' tract in 1947–48. By about 1950, it had spread to cover nearly 1,17,000 acres in the South zone. A similar strain K. 5 developed at Coimbatore as a reselection effected in 1935–36 in F_7 of a suspected natural cross involving indicum N. 14 x cernuum 99 and isolated as a true breeding strain in the year 1937–38. After repeated trials in the districts, this strain was released for general cultivation in 1944–45 and covered about 80,000 acres in 1950 in the Coimbatore tract.

These two hybrid strains under general distribution had a mean ginning percent of 30–31 and gave a lint yield of about 100 lb per acre only. It was also felt at this stage that there was further scope for improvement in lint quality in the South Indian *arboreum* cottons. Besides, the cotton breeding policy in the State was switched over to the evolution of plastic strains suited for wider environmental diversities. In view of these considerations, an intensive breeding Scheme for the further improvement of Tinnevellies and Karunganni cotton in this State was launched in 1949–50 with the financial assistance of the Indian Central Cotton Committee.

Evolution of K. 6 (Pandyan): The breeding project known as Karunganni Improvement Scheme which commenced functioning in June 1949 had for its objects the evolution of a strain of Karunganni (G. *arboreum*) cotton with a staple length of 15/16" or more, a ginning percent of 34, spinning 40's H. S. C, reaching an yield level of 150 lb lint per acre and suitable for cultivation in the entire black soil stretch of Central and Southern districts of this State.

As a result of intensive breeding work carried out under this Scheme through selection and trial of a very large number of useful hybrid progenies built up earlier on this station and those obtained from Coimbatore, a new strain 6186–9 which is not only suitable for the two distinct zones of the tract by virtue of its plasticity, but which also excels the existing strains, K. 2 and K. 5, was evolved. This new strain was first isolated in the year 1947–48 in F_{11} of an inter strain cross involving the parentage of 52–2 x 1523–R. Culture 52–2 was in its turn derived from a cross involving cocanadas 49 (*arboreum* race *indicum*) and culture No. 114 E of the parentage indicum N. 14 x cernuum. The other constitutent parent strain viz., 1523–R had been isolated in a suspected natural cross involving indicum N. 14 x cernuum 99 and crossed with 52–2 in the year 1936–37. Thus the parentage of the strain 6186–9 K. 6 (Pandyan) may be represented as [indicum 49 x (indicum N. 14 x cernuum)] x [(indicum N. 14 x cernuum) x (?).]

An overall review of this new strain in 67 trials on cultivators' holdings during the last five seasons and 16 trials on the Agricultural Research Stations, Kovilpatti and Coimbatore during the past eight seasons confirmed its allround superiority viz., 21 percent increased yield of lint, 7 percent longer staple, 8 percent finer lint and 13 percent better yarn strength over the existing strains K. 2 and K. 5, supporting its extension for general cultivation in the tract, approved by the Indian Central Cotton Committee (Kesava Iyengar et al).

The seeds of the new strain 6186–9 christened as K. 6 (Pandyan) are being multiplied for distribution for general cultivation in the tract from 1956–57.

Further yield trials of this strain at the breeding centres, Kovilpatti and Coimbatore as also on 20 cultivators' holdings in the tract during 1957–58 revealed that it continued to maintain its allround superiority over the control strains K. 2 and K. 5 which it is to replace. The relevant data on its comparative performance with the control strains K. 2 and K. 5 are summarised below.

TABLE I

Mean yield, ginning percent and halo-length in trials on the Agricultural Research Stations (1957-58).

S. No.	Strain No.	Kapas yield lb/acre			Ginning percent			Halo-length in m. m.		
		Kovilpatti	Coimbatore	Mean	Kovilpatti	Coimbatore	Mean	Kovilpatti	Coimbatore	Mean
1.	K. 6 (Pandyan)	330	390	360	33·0	33·1	33·1	24·6	24·7	24·7
2.	K. 2	250	348	299	31·2	33 3	32 3	22·5	23·1	22·8
3.	K. 5	275	362	319	30·2	31·1	30·7	23·4	22·0	22·7

On the average, the new strain K. 6 (Pandyan) has recorded 20 percent increased yieid of *kapas* over K. 2 and 13 percent over K. 5. In ginning percent and halo-length, the superiority over K. 5 is more marked than that over K. 2.

TABLE II

Mean yield of kapas, ginning percent and halo-length in 20 trials on the cultivators' holdings (1957–58).

S. No.	Strain No.	Kapas yield lb/acre			Ginning percent			Halo-length in m. m.		
		Tinnies Tract (12 trials)	Karunganni Tracts (8 trials)	Mean (20 trials)	Tinnies tract	Karunganni tract	Mean	Tinnies tract	Karunganni tract	Mean
1.	K. 6 (Pandyan)	245	504	349	33·6	35·0	34 1	25·4	25 3	25·4
2.	K. 2	211	..	303	32·5	..	32 6	22·4	..	23·2
3.	K. 5	..	442	..	..	32·8	..	..	23 7	..

The superiority of the new strain K. 6 (Pandyan) over the control strains K. 2 and K. 5 for all the three economic attributes is confirmed in the trials on the cultivators' holdings in the tract also.

Besides, it continued to maintain its better yarn strength (64 lb) over K. 2 control (54 lb) in mill tests (for nominal 26's) conducted for the third time in succession and fetched Rs. 190/- more per candy of 784 lb lint over K. 2.

Scope for further improvement: It may therefore be mentioned that the evolution of K. 6 (Pandyan) from inter-racial hybrids of G. *arboreum* is a land mark in Karunganni cotton improvement work

pointing towards the immense potentialities of hybrid materials built up on this Station under the auspices of the Karunganni Improvement Scheme, for further exploitation towards the newer stepped up objectives of evolving a Karunganni strain with a mean fibre length of 1–1/32" and above and a spinning value of 40's H. S. C. maintaining at the same time a ginning percent of 33 and yielding capacity of about 125 lb lint per acre of the new strain K. 6 (Pandyan).

It is therefore hoped that the large number of long stapled cultures undergoing tests in the various stages of breeding are likely to meet this stepped up objective.

Summary : The evolution of improved Karunganni (G. *arboreum*) strains and their progressive superiority in yield and quality achieved through systematic breeding work carried out intensively in various stages at the Agricultural Research Station, Kovilpatti since its inception in 1901 are discussed, indicating the scope for further improvement towards the newer stepped-up objectives for quality improvement.

Acknowledgment : The authors' thanks are due to the Cotton Specialist, Coimbatore and the Assistant Cotton Specialist, Karunganni Scheme, Agricultural Research Station, Kovilpatti for the encouragement given in writing up this note.

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