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Modern Trends in Indian Agriculture: Millets and Pulses Improvement

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MILLETS

Introduction: In the United States of America, Union of South Africa and in Australia where agriculture is highly advanced, millets are grown as feeds for poultry and pigs. The converted meat is consumed as human food. Unlike these countries, in India, millet grains are used for human consumption and the straw as cattle feed. Under these circumstances, it is not surprising tht the best quality of millet grains and high quality of millet straw in the world. are found in this country.

Madras and Bombay are the two states in this country to specialise in millet breeding work from an early date. The contributions to Sorghum breeding at the Agricultural Research Station, Coimbatore in Madras under the lnadership of G. N. Rangaswamy Ayyangar, Millets Specialist are the most extensive and comprehensive is the tribute paid by the American Year Book of Agriculture 1936 with reference to the fundamental Research work dont at the Madras State (Martin 1936). The other states which have large areas of millets are following suit. For a long time the all-India policy for millets inprovement was lukewarm as greater stress was paid for the improvement of wheat, paddy, cotton, sugarcane and oilseeds. A recent review of the Scientific research done on an all-India basis pointed out the inadequate attention shown to these poor man's crops though they occupy a large area in the country.

The Indian Council of Agricultural Reserch convened an all-India Millet workers Conference at Kolhapur in 1955 when all the millet breeders of India along with the leading millet cultivators met and discussed the lacuna that is to be filled up by research on an all-India basis. As a result of thse recommendations, reorientation of millet breeding has been made on the following lines in the Madras State.

Modern Trends In Millet Research: Millet improvement in the Madras State is in progress for the past three decades. The three major millets viz; Cholam *(Sorghum* spp.*)*, Cumbu *(Pennisetum)*, Ragi *(Eleusine coracana)* and five minor millets, Tenai *(Setaria italica)*, Varagu *(Paspalum scrobiculatum)*, Samai *(Panicum miliare)*, Panivaragu *(Panicum miliaceum)* and Kudiraivali *(Echinochloa)* have been studied intensively. Millets being localised crops in the various zones of the State, it was found that strains evolved at Coimbatore (Central Research Station of the State) did not do well in the various tracts although they were best performers for the variety at the Coimbatore centre. This necessitated the opening up of a number of zonal research stations in the state (Krishna Rao & Subramaniam 1950). The intensive work done resulted in 23 strains in cholam, seven in Cumbu, five in Ragi and six in minor millets. Thus we have improved strains suitable for the entire state except the Ariyalur tract for which evolution of strains is in the final stages of trials. For a breeder three decades ago, this would have been the ultimate goal. But thanks to the advancement of science and scientffic breedig, it can be said that these 30 years of work would form only the basis for further improvement which is being visualized.

Though millets have specialised themseives for zones, recent trials have shown that some of the strains evolved by hybridisation have a tendency to suit a number of zones. This indicates that it is possible to evolve universal state strains in Cholam, Cumbu and Ragi by hybridisation of selected parents and testing a number of purified progenies in the entire state and fixing a strain with sufficient plasticity. The evolution of such strains would facilitate easy multiplication and rapid spread of improved strains.

Previously it was presumed that if the duration of the millet crop was shortened the yield also would tend to be lower. Trials during 1955 disclosed that one of the very short duration types (85 days) of irrigated Cholam, strain Co. 12 evolved at Coimbatore is capable of giving a very high yield of 6,000 lb. of grain under heavily manured conditions, The high yield has been found to be due to the capacity of the strain to utilise the manure efficiently. The study of such high fertility strains needs further exploitation as the country is steadily becoming manure conscious.

The nutritive value of millet grain has not been studied properly from genetic and agronomic angle. A variety of white Ragi cultivated in the Mysore tract was found to contain a high

percentage of protein (13 %) but its yield was poor. By hybridisation, a high yielding white Ragi strain with high percentage of protein has been synthesised. Chasatio, a variety of sorghum of Bombay has been reported to contain 17 % of protein as against the normal of 10 % (Naik & Abhyankar 1956). This variety and other types with high nutritive value will form suitable parents for inducing higher protein content in the improved strains of the State. Preliminary studies done at Coimbatore have shown that environment like season, fertility of soil and the quantity of soil moisture, have been found to play a part in increasing or decreasing the protein content of millet grain. A study on these aspects would go a long way in enriching the millet grain and thus improving the general standard of health in this countary where protein food is scarce.

Nearly 60% of the cattle of the state subsist on millet straw which is preferred to that of paddy. Not only the quality of the millet straw is better but also the quantity is more due to the fact that a larger proporation of straw as compared to grain is obtained in the case of the three major millets. In Cholam, the quality of many of the existing strains has been improved by infusing juicy stalks by hybridisation (Krishna Rao & Mahudeswaran 1955). Evolution of a grain-cum-fodder strains is also possible in the other two major millets and work on this line has been taken up.

Cholam has been known to be a highly drought resistant crop. In the United States of America it has been named as crop–camel as it is able to come up with the minimum quantity of water. A wild relative of Cholam, *S. halepense* is known throughout the world for its super-drought resistance and its tenancity to persist in highly arid regions (Rangaswamy Ayyangar & Ponnaiya 1941). Since it has 40 chromosomes (2n number) it does not cross readily with the cultivated sorghums which have 20 chromosomes. By repeated and persistant trials it was possible to cross *S. halepense* with Periamanjal cholam *(S. durra)*, the popular rainfed variety at Coimbatore (Krishnaswamy *et al.* 1938) The first generation was partially sterile but back-crossing with the cultivated parent has improved its fertility. The progenies of these crosses possess a high degree of drought resistance inherited from the wild parent. Evolution of super-drought resistant economic sorghums with *halepense* blood has been taken up.

In Cumbu practical utilisation of hybrid vigour has been achieved at the Millet Breeding Station, Coimbatore and this is the first record in the world for this crop. (Krishna Rao *et al.* 1951).

Two medium duration hybrids X. 1 and X. 2 have been evolved and they are under distribution. Although these hybrids are giving very high yields the seeds have to be replaced every year. This involves enormous cost and has hampered the progress of seed distribution in this state. A new technique of utilising hybrid vigour by the use of synthetic varieties has been successfully made in maize in America. The synthetic varieties which consist of six or more parent-combinations maintain their vigour for at least three generations and it is enough if the seeds are replaced once in every four years. Evolution of a synthetic variety in Cumbu has just been taken up and the results achieved will make utilisation of hybrid vigour felt in the entire state.

Evolution of pest and disease resistant strains have given encouraging results. Types resistant to the Cholam fly *Atherigona indica* have been fixed (Ponnaiya 1951). A high yielding Striga resistant Periamanjal Cholam *(S. durra)* has been synthesised by hybridising economic Periamanjal Cholom with an African type Bonganhilo which is found to be highly resistant to the parasite but possessing low yield and poor quality of grain. Rust resisting Cumbu and Tenai types have been isolated and their resistance under various conditions are being studied (Ramakrishnan & Sundaram 1955 and 1956). The resistant types will be used for improving the existing strains by hybridisation.

PULSES

The main source of proteinaceous food in the vegetarian diet of the Madras State are the pulses. The production of pulses in the State is very low, and work on the improvement of the crops for high yieid has been in progress. As a result of the work done, one strain in each of redgram *(Cajanus indicus)* Bengalgram *(Cicer arietinum)* and greengram *(Phaseolous aureus)* has been evolved. Release of improved strains of blackgram *(Phaseolus mungo)* and horsegram *(Dolichos biflorus)* is in the final stages. Unlike millets, pulses have sufficient plasticity and are able to accomodate larger tracts.

Future Trend of Work : As in the case of millets, the genetic and the environmental factors that affect the protein content of pulses have to be studied for enriching their nutritive value. The pulses crops are also useful as rotation crops as they increase the fertility of the soil by forming root nodules. Gentic and environmental factors have been found to influence the formation of these

rhizobial nodules. Research work on the above lines has been taken up in the two important pulse crops of the state namely redgram and blackgram.

REFERENCES

Krishna Rao, P. and Subramaniam, P.	(1950)	Improvement of Patcha Jonna or Yellow Sorghums of the Cuddapah and Kurnool Districts – Madras, agric. J. 37. 55, 58.
Krishna Rao, P., Kunnikoran Nambiar, A. K. and Madhava Menon, P.	(1951)	Maximisation of Production by cultivation of Hybrid strains with special reference to Cumbu (Peral Millet) Madras agric. J. 38 : 95–100.
Krishna Rao P. and Mahudeswaran, K.	(1955)	Improvement of the quality of fodder in Periamanjal Cholam *(S. durra)* in Madras State : *ibid* 42 – 229–232.
Krishnaswamy, N. Dorairaj, V., and Thangam, M. S.	(1953)	A Note on the Hybrid between Grain Sorghum and Johnson Grass. Curr. Sci. 22 : 311.
Martin, J. H.	(1936)	U. S., Dept. of Agriculture, Year Book. pp. 554–5.
Naick, M. S. and Abhyankar, V. S.	(1955)	Nutritive value of Improved strains of Jowar *(Sorghum vulgare* Pers*)* Poona agric. Coll. Mag. 46 : 130–37.
Ponnaiya B. W. X.	(1951)	Studies in the Genus Sorghum, I & II, The Cause of Resitance in Sorghum to the Insect Pest *Atherigona indica* J. Madras, Univ. 21B : 203–17.
Ramakrishnan, T. S. and Sundaram, N. V.	(1955)	Studies on the Rust on *Setaria italica* — Proc. Indian Acad. Sci. 41 B : 241–46.
Ramakrishnan, T. S. and Sundaram, N. V.	(1956)	Further studies on Puccinia penniseti ibid 43 : 190–196.
Rangaswami Ayyengar, G. N. and Ponnaiya, B. W. X.	(1941)	Studies in *Sorghum halepense* ibid 13 : 157–62.