CHAPTER VI
Dissemination of Agricultural Science

“The common belief has been that the natives of this country can, in respect to the processes of agriculture, derive little or no benefit from any instruction which European science can give them. Such a belief rests, perhaps upon observation of the obvious progress, which has been made in many of the elementary requirements of agriculture, in regard to tillage, rotation of crops, and so forth. But it has often been lost sight of that sort of knowledge is only rudimentary and empirical, and that recent experience in all parts of the civilised world shows conclusively that there is no branch of industry in which the effects produced by the intelligent application of science are more certain or more remarkable. We can not doubt, that, when light of science has been properly brought to bear upon Indian agricultural experience, the results will be as great as they been in Europe.”

Wrote Lord Mayo in his proposal for an Agricultural Department to the Secretary of the State in 1870.

In the preceding chapter, the discussion focussed mainly on the nature and expansion of agricultural research. This chapter seeks to discuss the mode and nature of dissemination of scientific agriculture and then assesses the use and impact of agricultural science.

Colonialism had assumed political power in the colony pretending to improve some of the existing technologies of the colonised regions. One may describe colonialism as a process of promotion of science-assisted progress in the colony under their control. The coloniser took the advantage of progress of science to project himself as a superior master. He projected himself as advanced not only economically but also in science and technology.1 On the other hand, his description of the colonised’s system was a ‘primitive that

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involved inequality and inhuman relation.’ Some of the early Indian reformers regarded colonial rule as a modernising force and even believed that subjection to the authority of superior power would lead to some innovation through use of science and technology.

Colonial Empire had rested its administration on the supply of local knowledge and information. It was therefore keenly interested in mapping, categorising, and decoding the native’s knowledge, resources, and attitudes. Applying the European experience, the Company servants and later servants of the Crown administration were engaged in preparing manuals, district gazettes, monographs and reports. Under official instruction, Buchanan conducted investigation in Southern India in 1800, and had published a multi-volume account in 1807. Nicholson prepared a manual of Coimbatore district. Special professional handbook was published on the cotton by Wheelar. Robertson also wrote a handbook of Saidapet farm and First agricultural Textbook in 1880. Cecil Wood wrote ‘Note Book on Agriculture’.

European experience was used for textualisation of Indian agricultural knowledge. The British had reoriented the process of textualisation of agriculture. Pre-British process of textualisation was not transformed as it did in Europe because, as Ludden observes, that what prompted textualisation elsewhere, were absent in South Asia. The literati in South Asia, he reasons do not seem to have had sufficient control over farm inputs to sustain managerial stance towards agriculture. Authors on agriculture in Europe for centuries had similarly recorded lore and observations about farming to make peasant wisdom known to the literate. But only when Europe in the eighteenth century moved towards scientific determinations of agricultural knowledge, its process of textualisation was also diverted to modern system of textualisation. Authors and publishers disseminated progressive, advanced technical expertise that was authorised tested and stored at the top and distributed from the top down. It
was defined at the top by the specialists using research stations, statistics and scientific techniques.

The establishment of the British administrative control influenced the textualisation of Indian agricultural knowledge too. The colonial bureaucracy directed attention in India for codification of agriculture knowledge. In the 1890s, the agricultural sayings and proverbs in Telugu and Tamil were compiled arranged and published on the request of the government by the scientific personnel of the agricultural department. Its collected oral wisdom again provided the data and administratively equipped them with the local knowledge. ‘The State no longer simply told Europeans about farming in India, it became the sole expert on Indian agriculture and came forward to perform its role as the biggest landlord leading to redefine the style and substance of modern agricultural enterprise.

Similarly the colonial government endeavoured to spread scientific agriculture through agricultural exhibitions. The earliest efforts of the department of agriculture in the Madras Presidency geared more to the work of agricultural exhibitions. Masefield in the context of Africa wrote that it was natural that extension staff coming from Britain where agricultural shows had historically played such a large part in the improvement of farming should wish to reproduce it in the Colonies. Agricultural shows were expected to generate a spirit of emulation among farmers. In 1854, Madras government ordered agricultural shows to be held in mofussil towns. Cash prizes were offered for the exhibition of best-improved commercial products such as cotton, indigo, sugarcane improved agricultural implements and livestock. Committee was appointed later to purchase superior produce of each district

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for displaying them at Madras. Agricultural shows were organised in 1856 in 17 districts, in 1857 in 10 districts. In 1858 shows were cancelled owing to revolt but again revived in 1859 but was reduced in number of shows. During 1864 to 66 shows were held in only Bellary and Tinnevelly districts. In 1874 on the proposal of the government a special show was organised in Saidapet Experimental Farm in Madras town but this as reported 'was not such an undoubted success but far from being failure.' Exhibits were sent to it from all parts of the presidency. There was a good show of cattle which was brought from Nellore.

From 1858, agricultural shows were modified making them into compartmentalised classes such as livestock, animal products, vegetable products, farm implements and machines. Usually exhibitions were arranged on the occasions of cattle fairs, jamabandi camps, ryot's socio-economic status conferences, health week celebrations, and cooperative district conferences where huge mass gathering were expected. Unlike earlier, these shows in later days laid more stress on the educational value. The exhibiting opportunity was used to spread the work of the department of agriculture through lantern lectures organised on different crop technique and curing of diseased plants, etc. Officials of the department visited every big show and they delivered public lectures followed by discussion on issues of improving agriculture. The committee on how to diffuse agricultural knowledge to ryots constituted on the advice of the Board of Agriculture identified three distinct purposes: first, exhibitions were of means of demonstrating to a large crowd of people either methods or produce, which is desirable that they should see or know about. Secondly, they were means of creating local enthusiasm; third, they were means of bringing a larger crowd of cultivators into touch with the workers of the agricultural department than could be otherwise brought together.

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6 Proceedings of Board of Agriculture in India, 20 November 1912, p. 27

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However, the agricultural shows fared no better. The descriptive comments on various fairs and cattle shows ranged from ‘distinct failure’ and total waste to farcical. The shows were rarely geared to the demonstration of agricultural practices or products. But cattle shows were successful in showing improved breeds, especially in the Ongole tracts, but the winners were usually breeders, which belonged to rajahs, zamindars and vakils. It was simply another avenue for the influential to show their wares. Small farmers had no means to breed cattle.

Improvements discovered experimentally at the central and district research stations induced the department of agriculture to put them into practical use. The government of Madras asked the department to institute demonstration farms for this purpose under its own trained supervisors. Agricultural officers too realised that the demonstration farm was the best way to reach the cultivator. Voelcker gave positive impressions on the advantages of the demonstration farms and strongly advised to establish them. The demonstration farms were to work for the purpose of showing on a practical scale, and of bringing to the door of the cultivator, the results of what has been found on experimental farms as an improved practice. The Department of Agriculture conducted field trials on cultivator’s farm at a number of villages in order to ascertain the relative yields. The demonstration farms were actually intended to show cultivators the result of a practice found by experiment. It was assumed by the agricultural department that when the ryot sees the improvement on his own lands under his own management creates confidence in the ryot. Also, it does away to a large extent with the obstacle to success, the idea that Government has some ulterior motive in inducing the ryot farms. Ryots were encouraged to accept new and renewed agricultural know-how.

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8. Madras Department of Agricultural Report, 1910-11, p. 10 and also see Madras Board of Revenue Proceedings No, 291, 8 August 1906
When the ryots saw the improvement, he realised that the Department was a benevolent one working for his good.\textsuperscript{11} One of the report from a district stated that the agricultural demonstrator was the centre of the general leaving influence of enlightened agriculture. Agricultural demonstrators were appointed by the department of agriculture for assigning them responsibility for all the advice the ryot were to be approached. With the assistants under his control, agricultural demonstrator supervised a whole agricultural work of a taluk, maintained stock depots for superior seeds, manure, improved implements, kept stock of bulletins and leaflets for distribution to ryots, arranges agricultural exhibitions and delivers popular lectures on agricultural improvement, touring constantly in taluk, keeps in intimate touch with the ryots.\textsuperscript{12} But these demonstrations embodied serious organisational constraints. These village demonstrations were not without its shortcomings. Successful demonstrations needed two plot of land, one grown by the cultivator and one by the department. The immediate constraint was the availability of land. The agricultural demonstrator could only work through the larger landowner who could risk a plot in experimentation. It was difficult enough but it was compounded by department’s perpetual lack of staffing.\textsuperscript{13} Demonstrators plot had to be at least overseen, if not worked by the agricultural demonstrator. The constraint imposed by the planting season meant that the demonstrator were restricted to a very few plots within close proximity of one another. At the height of the plot Programme all together only 600 demonstration plots spread among millions of cultivators.

Most important development to aid scientific agriculture was formation of agricultural associations. In their orders to provincial government,

\begin{footnotesize}
\textsuperscript{11} Agriculture Department, Madras, \textit{A Popular Account of Agriculture}, Vol. I, Madras, Government Press, 1922, p. 75
\textsuperscript{12} \textit{Ibid.}, p. 19
\textsuperscript{13} Ananda Rao, Results of Demonstration of Agricultural Improvements in the Madras Circle carried out in 1924-27. (Madras, 1929) The author recounts the default of getting substantial ryots to donate plots for demonstration. In one district the department had to use the land of the Raja of Panagal, unusual that they usually acquired the land of the owner who at least lived in the village, if not actually cultivating his own land.
\end{footnotesize}
government of India pointed out the necessity for agricultural department working through the agency of native agriculturists. The reports of the Agricultural Committee, Madras 1888 noted that

"The development of private enterprise is a subject which would well repay attention, whether it took the form of encouraging local associations or private individuals. It is indeed matter for consideration. Whether the chief efforts of the agricultural departments should not be devoted to the stimulation of enterprise and self-help, not merely because the result of the efforts by the mass of the farmers must be far greater than that of the any government effort, but because of the result in the strengthening of public self help reliance and in a protanto diminution of the leaning government."\textsuperscript{14}

In 1887 one district officer wrote with foresight to the authorities urging to open agricultural associations:

"I consider that both for this and for agricultural experiment and progress, local associations are absolutely necessary. It is impossible to conduct experiments either by officials or by isolated ryots, the former are busy and too inexperienced, the latter are too shy and conservative, too half-hearted or sceptical, too careless of the result of supposed, official fads. We ignore at present the large amount of experienced indigenous agricultural talent, we fail to utilise a vast and trained force lying to hand because we have failed to organise it into rank with our own forces. If the competition is the nineteenth century watch word, association is doubtless advancing claims for the twentieth century; this bond alone can unite the disjecta membra of the agricultural body politics. I consider, therefore, that we should organise in every district agricultural associations; not isolated societies, dependent upon, perhaps, temporary local knowledge or interest and enthusiasm, but while possessing local life and organisation dependent for permanent life and inspiration upon a central organisation with head quarters at the presidency town. The central organisation would consist of all the best talent and knowledge available in the whole presidency, worked officially in your department, but corresponding and having frequent conferences with its members in the districts. These members would of course be principal members of the district associations, which in turn would have members in every chief town and village in a district. The result would be not only that the central association would supply intern even to the remotest villages, ...the

\textsuperscript{14} Report of the Agricultural Committee, Madras, 1888, p. 121
results of experiments, moreover, would be rapidly spread over the district, instead of being confined to the pages of the district gazette.\textsuperscript{15}

Stimulus for the establishment of agricultural associations was mainly originated from the force of external influence. A letter from a district officer contained the following observation.

"In forming them (agricultural associations) we shall but follow in the footsteps of the west, in England the Royal Agricultural Society, I believe, is the centre of English-farming talent, and local associations are affiliated to it. On the continent, I believe that a bureau of industry usually supplies the primary stimulus, and local associations obtain suggestions, aid, money and grant and so forth from the bureau. One of the most perfect of these departments appears to be in Wurtemberg where there is a bureau of industry partly official, partly of non-official members residing in all parts of the kingdom but coming for conferences, and being of course in correspondence with the central bureau. This bureau had had the most extraordinary effect upon all classes of industry, agriculture or otherwise our own association."\textsuperscript{16}

But agricultural associations in India waited for right change to come. The government also wanted agricultural societies to come up to encourage improvement of agriculture on the similar model of societies of Europe. The realisation of the need of an organisation induced the government of Madras in 1905 to create the Central Agricultural Committee and to extend support till 1916. The committee was affiliated for conduct of their administrative function to the Victoria Technical Institute. The purpose of the committee was mainly to function as a facilitating agency through mediating between government and district agricultural associations. With the support of governmental assistance in annual grant-in-aid, it executed wide range of functions. The Central Agricultural Association was to assist in establishing and to aid and advice already established agricultural associations in the mofussil to act as medium of communication between the Government and these Associations, to collect, collate and distribute new information on practical and locally useful

\textsuperscript{15} Report of the Agricultural Committee, Madras, 1888, p. 121
\textsuperscript{16} Report of the Agricultural Committee, Madras 1888, P. 121-22
agricultural practice, to study the proceedings of similar associations and of agricultural department elsewhere in India, and to communicate to the mofussil associations any information to their members and to the ryots generally by translating them into the vernacular and publishing them in leaflets and in the special village sheets of the district. ¹⁷

At the conference of Indian Industries held at Benaras in December 1905, K. Beauchanan, joint honorary secretary to the Central Agricultural Committee, Madras, presented a very ambitious proposal drawn for the committee that "There are other directions, of course, in which it would be possible for a central agricultural organisation to help in the improvement of agriculture. It might, for instance, establish a permanent central exhibition of select agricultural product and implements. It might offer prizes or induce others to offer prizes, for essays on agricultural topics. It might do something in helping to develop cooperative credit societies, and in developing agricultural cooperation, generally in such matters such as the buying of manures, seeds and implements, selling of agricultural produce, the securing of the favourite railway rates for agriculturists, and as the work developed it might establish a journal on the lines of the journal of Agricultural Associations and Societies in other countries." ¹⁸

With the organisation of Agricultural Committee, Madras Agricultural Society was redesignated as the Central Agricultural Association in 1904. The Society was originally established in 1895 in Madras by prominent people under the direction of Castal Stuart, then member of the Revenue Board. The Society was supported by judges, Zamindars and lawyers who actually were not persuading agriculture directly but their lands were cultivated either by the tenants or shareholders. The Central Agricultural committee had employed one agricultural Inspector in 1912. In the first year, he visited agricultural stations at Palur, Koilpatti, and Coimbatore. In the district of Chingleput, lectures were delivered on paddy cultivation, Combodia cotton and had demonstrated iron

¹⁷ Indian Agriculturist, March 1906, Vol. XXXI, No. 3, p. 77
¹⁸ Indian Agriculturist, March 1906, Vol. XXXI, No. 3, p.78.
ploughs supplied to him by Burn Company. Similarly, the Committee’s honorary Secretary, Diwan Bahudur M. Audinarayana Ayyar, toured the presidency in endeavouring to stimulate interest in organising local associations.

<table>
<thead>
<tr>
<th>Sl No</th>
<th>District</th>
<th>Branch Agricultural Association</th>
<th>When Formed</th>
<th>When Affiliated with Central Agricultural Committee</th>
<th>When Disaffiliated</th>
<th>Condition as reported by Collectors in 1910</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ganjam</td>
<td>Saidapet, Palakimedi, and Aska</td>
<td>1906</td>
<td>1907</td>
<td>All the District Agricultural Associations became affiliated to the Central Agricultural Committee in 1907 except Chingleput</td>
<td>Reconstituted, resolved to do practical work.</td>
</tr>
<tr>
<td>2</td>
<td>Vizagapatam</td>
<td>Narasapam, Anakapalle, Veeravalli and Paravatipur</td>
<td>1905</td>
<td>1907</td>
<td></td>
<td>Has had no success and is doing no good</td>
</tr>
<tr>
<td>3</td>
<td>Godavari</td>
<td>Rajahmundry, Ramachandrapuram, Peddapuram, Nagaram, Amalapuram, Polavaram</td>
<td>1905</td>
<td>1906</td>
<td></td>
<td>Meetings consist of two or three pleaders and officials</td>
</tr>
<tr>
<td>4</td>
<td>Kistna</td>
<td>Narasapur, Bapatla, Bezawada</td>
<td>1905</td>
<td></td>
<td></td>
<td>Has had no part in any improvements in agriculture that have taken place.</td>
</tr>
<tr>
<td>5</td>
<td>Guntur</td>
<td>Tenali, Venakonda, Kalikota, Gurzala, Sattenapalle, Guntur, Narasaraopet</td>
<td>1905</td>
<td>1906</td>
<td></td>
<td>The Nellore District Agricultural Association has been re-affiliated to the Central Agricultural Committee.</td>
</tr>
<tr>
<td>6</td>
<td>Nellore</td>
<td>Ongole</td>
<td>1905</td>
<td>1906</td>
<td></td>
<td>Has been doing some food but is not flourishing</td>
</tr>
<tr>
<td>7</td>
<td>Bellary</td>
<td></td>
<td>1905</td>
<td></td>
<td></td>
<td>Apparently dead</td>
</tr>
<tr>
<td>8</td>
<td>Cuddapah</td>
<td></td>
<td>1905</td>
<td></td>
<td></td>
<td>Spends its time in passing resolutions but does no useful work.</td>
</tr>
<tr>
<td>9</td>
<td>Kurnool</td>
<td>Pattikonda</td>
<td>1905</td>
<td>1906</td>
<td></td>
<td>Has released into lethargy rarely meets.</td>
</tr>
<tr>
<td>10</td>
<td>Anathapur</td>
<td>Penukonda* Anantapur Goosy</td>
<td>1905</td>
<td></td>
<td></td>
<td>No use in this district.</td>
</tr>
<tr>
<td>11</td>
<td>Chingleput*</td>
<td>Sembjam</td>
<td>1905</td>
<td>1907</td>
<td>Affiliated to the Central Agricultural Committee</td>
<td>No use in this district.</td>
</tr>
</tbody>
</table>

20 Report of the Madras agricultural Department 1913-14, p.17.
<table>
<thead>
<tr>
<th>No.</th>
<th>District</th>
<th>Branch Associations</th>
<th>Year(s)</th>
<th>Status/Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>North Arcot*</td>
<td>Chittoor, Tingali, Ami, Sholinghat</td>
<td>1905 1905 1906</td>
<td>Has ceased to do any work.</td>
</tr>
<tr>
<td>13</td>
<td>South Arcot</td>
<td></td>
<td>1906</td>
<td>Composed of non-agriculturists. Retards progress of agriculture.</td>
</tr>
<tr>
<td>14</td>
<td>Tanjore*</td>
<td>Mayavaram, Patukotni, Negapatam, Kumbakonam, Tanjore.</td>
<td>1905 1905</td>
<td>Does not show many signs of life.</td>
</tr>
<tr>
<td>15</td>
<td>Trichinopoly</td>
<td>Kualai, Musiri, Ariyalur, Perambalur.</td>
<td>1905 1907</td>
<td>Has been reconstituted. Proposes to disaffiliate from central Agricultural Committee, as it gets no return for subscription.</td>
</tr>
<tr>
<td>16</td>
<td>Madura</td>
<td>Bodinayakakanur, Dindigul, Ramnami, Sholavando, Melur.</td>
<td>1906 1907</td>
<td>Shows certain signs of activity.</td>
</tr>
<tr>
<td>17</td>
<td>Timnvelly</td>
<td></td>
<td>1905</td>
<td>Moribund. Of use only for distributing leaflets.</td>
</tr>
<tr>
<td>18</td>
<td>Salem</td>
<td>Namakkal</td>
<td>1905 1908</td>
<td>Has no vitality.</td>
</tr>
<tr>
<td>19</td>
<td>Coimbatore</td>
<td></td>
<td>1906</td>
<td>Has done nothing towards the improvement of agriculture.</td>
</tr>
<tr>
<td>21</td>
<td>South Canara</td>
<td>Mangalore, Puttur, Condapur</td>
<td>1906 1905 1906</td>
<td>Working well and on the right lines. Consists largely of agriculturists. Not doing well.</td>
</tr>
</tbody>
</table>


Note: Where no remark appears against a Branch Agricultural Association, the remark against the District Agricultural Association is to be taken as applying.

These associations were formed shortly before the formation of the Central Agricultural Committee in July 1905 and the remaining Associations were formed subsequently as the result of official encouragement at the instance of the Central Agricultural Committee.

# Energetic and does good work.

In 1883, an Association was started by a former student of agricultural college of Saidapet, known as 'Madurai Farmer’s Club.' The Association maintained an experimental farm consisting of 30 acres of land for purpose of experimenting. It had carried experiments with improved ploughs, water lifts, fodder crops, tobacco, and stock breeding work. However, the Farmer’s experiments did not gain any definite experience and soon ceased its
experiments on crops confining the work only to dairy farm, which performed well owing to a ready sale of milk in the town. Voelcker during his investigations in India in 1889 had visited this farm. He reported the existence of fourteen cows and some of them were of famous Adden variety. Each cow yielded daily average milk of 12 pounds was recorded. 21

Since 1904, movement restarted to open agricultural associations. As a result, each district established one district agricultural association and had more than one branch associations. Altogether there were 22 district agricultural associations with 46 branch associations in 1909. These associations, in conjunction with the agricultural department were to recommend to the ryot variety of crops suited to particular climate and of irrigation facilities.

In Tanjore district, a district association was established by Castle Stuart, then Director of Agriculture during 1904. The Association performed much good work. The first annual report published by the association documented large amount of work accomplished by the Association. They include

"Collection of samples of improved agricultural implements, practical demonstrations in fibre-extracting, rope making and cloth manufacture from stalks, establishment of several oil engine installations for irrigation purposes, the introduction of new and selected sugarcane seed; the establishment of a model farm of eight acres of Padua lands; the creation of museum of Agricultural Products with a library of agricultural products, bulletins and reports, the setting apart a model plots of land by private landholders for experimental cultivation in conjunction with the agricultural department, the establishment of a vernacular information on subjects as the importance of various kinds of measures of well irrigation of new methods of cultivation, the introduction of new implements and new crops, and the adoption of extended cultivation of profitable crops such as sugarcane, turmeric, the supply at cost price of vernacular books on agriculture, the introduction of improved agricultural implements from ceded districts and elsewhere, and the instruction

of local ryots in their use—such were the principal items in the Association’s first year of working.22

At Penugonda in Ananthapur district, an agricultural association, first of its kind in the region was organised since 1903.23 Association was maintained for several years especially in organising annual agricultural exhibition and cattle show during the celebration of Kothacheruvu car festival. The Association’s work was appreciated by the collector, Scott who requested the Secretary to improve the local livestock through annual cattle shows. In 1906, the Association purchased improved implements consisted of one chaff cutter at the expense of forty rupees and five grape thinning scissors. The Association had popularised the use of the Bordeaux mixture as cure against mildew disease on the grape vines, system of thinning of several new varieties of grape vines were also introduced. The Association had maintained a small journal in Telugu ‘Krishi’ through which had disseminated useful knowledge in agricultural matters in its own way among the educated local ryots.24

In Krishna district, an agricultural association was established at Ellore town in 1908. The Association was formed initially with fifty members; twenty of them were real cultivators. Each one of the members had paid to the Association a subscription of three rupees annually. The association’s office was existed in one part of the estate office of the Nidadavole Andameduru owing to a lack of own permanent building. The Association owned agricultural implements for purpose of hiring them to its members: one harvestation machine, one machine for arranging grass into bundles (self binder), two Swedish iron ploughs, one chaff cutter, harvestation machine and one country plough.25

24 Indian Agriculturist, March 1906, Vol. XXXI, No. 3, P. 78.
The Society's works were looked after mainly by an efficient secretary, T. Rajagopala Rao, a retired Inspector of agriculture at Bezawada Agricultural Station. The Secretary was responsible for varied duties: (1) to collect agricultural information from different places of India and abroad and selected them for publication in Society's Journal, (2) to reply to those agriculture related questions requested by members of the Society and other agriculturists, (3) to deliver lecture for public on agriculture in exhibitions, festival occasions, (4) to conduct soil testing and advice to farmers, (5) to demonstrate to public how to use modern machines and implements those possessed at the Association, (6) to organising annually livestock exhibitions of the Society, (7) to diagnosing and eradicating disease of livestock, (8) to educate farmers on improved seed, (9) to protect stud bulls of the Society.

Annual exhibitions were held regularly since 1906 especially livestock exhibitions of the society had gained popularity in the whole district. The officials of the agriculture department had attended the exhibitions regularly. The Association's fourth livestock exhibition was conducted on February 26 to 28, 1910. Farmer's discussions were conducted on the last day. The fourth exhibition of the association displayed 700 varieties of seeds and 500 stocks.26

Whereas the agricultural association which was established at Vizagapatam departed from the working of the other associations through extending its membership for all classes of people. The association constructed own workshop for manufacturing agricultural implements ranging different improved ploughs. The ploughs manufactured by the Association had been made up of partly iron and partly of wood and therefore were lighter and cheaper than the cost of the imported Cownpore iron plough.27

The ploughs were constructed to suit to the need of the local conditions and sold them at production cost of Rs. 1-12-0 while that iron one was to be expensed at Rs. 7-4-0. The ploughs require to be pulled a pair of bullocks

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26 Ibid.
costing of Rs. 25 or Rs. 30 and was within the reach of ryots own means. In ploughing the land, it (plough) through the earth only on one side and thus leaves on intervals of untilled land between furrows. The improved common plough was another type manufactured in the workshop of the society was used largely by local ryots as it could dig the land twice as deep as the common plough. Besides them, other implements acquired by the Association consisted were Nolla for levelling land, Gorru or seed drill, Guntaka for weeding and Papita for covering seed with earth. The Society imported them from Bellary and were reproduced some models in its workshop intending to suit to requirement of the local conditions.

Despite such performance by some associations, the movement could not work to the governmental expectation. Excepting some of them, many district agricultural associations hardly could make any progress. The letter issued by the government on the progress achieved by central agricultural associations was observed that nearly all the district and branch associations were in a moribund condition. It further suggested that “it was quite clear they must all be wound up very shortly for want of funds if no means could be devised for awakening the interest of the actual cultivators and land owners of the work.” It was suggested that “the only feasible method of making these association into useful living bodies seemed to lay in reconstructing them, and admitting only a small number of members who had a real knowledge of the subject.”

Since 1912 the government had changed the tactics of how to approach the actual cultivators as the district agricultural associations failed to get in touch with real cultivators. The Cooperative Societies Act of 1904 which provided for credit for non credit agricultural cooperative societies. Accordingly in some of the district agricultural associations were reorganised on the lines suggested by the Director of Agriculture. A fresh start was made in the shape of village Associations as well as divisional Associations.
The Malabar district had established more number of village associations, their number in this district alone was increased to twenty-six associations. These associations were worked for improving agriculture in the taluk level.

"The main object of the Agricultural Association organised in the division is to be the medium between the Agricultural Department and the farmers for the adoption of improved methods of cultivation and the introduction of improved implements as may from time to time be advocated by the agriculture Department. No fee was levied from the members in the divisional Association or its branches at Mannargudi, Porte Navo, Vridhachalam and Tittaigudi. The Revenue divisional officer was the ex-officio chairman in all associations. Ryots paying an assessment of Rs. 400 and upward and the members of the Taluk Boards were formed members of the Divisional Association. In all the branch associations, ryots who pay an assessment of Rs. 150 were admitted as members. There were 51 members in Mannargudi Village Association, 20 in Porto Novo Village Association and 39 in Tillaigudi Village Association."28

The Kumbakonam Agricultural Association in Tanjore district had worked in distributing seed and manure to its members. The Society had supplied to its members green manure seeds imported from the agriculture department. During 1912, 20 ploughs made by Messers Burn and Co. were sold, and lines of the improvements suggested by the department were demonstrated to the members of the Society. C.R. Lakshmivaraha Iyengar had served as secretary to the Society.29

At Nidadamangalam in Tanjore district, a Cooperative Agricultural Association had started in the year 1916 with 44 members. The Society under the direction of Secretary Raisaheb A. Sethurama Ayyar, an old student of the Saidapet Agricultural College worked mainly on manure improvements. By 1919, members of the Society increased to 84. During 1918-19, Society produced 8 ½ tons of bone meal and 1 ton of flour phosphate at a cost of Rs. 60 and Rs. 35 per ton respectively and sold them to members at Rs. 65 and Rs. 37

½ per ton respectively. Beside supply of its own manures, society purchased other kinds of manures for members. During 1918-19 the Society arranged to it members 15 tons of fish guano, 12 candis of caster cake, 5 candis (1 cnadiy equal to 509 lb) of groundnut cake, 1104 Madras Measures (one Madras Measure was equal to nearly 2.5 lb) of Kolingi, 50 MM of Indigo manure and 96 MM of Ramagaruda Samba seed paddy at half the ruling market prices. Besides them, the Society helped its members getting from the government entomologist fish oil soap as a remedy for the hoper pest on graft mango trees. The Society presented a report that “not only the manure society undersells all the manures such as bone meal, flour phosphate, fish guano but its members have realised real benefit by the application of these members.\(^\text{30}\)

An association with altogether a different purpose was started at Coimbotore Agricultural College. This Association called Madras Agricultural College Students Union was formed with the twin objectives to foster brotherhood and exchange of ideas. Students educated at Saidapet College and later on Coimbatore College of Agriculture dispersed into different places thus lost touch with college. At the old Saidapet Agricultural College, it appears that there was an association called Agricultural Students Association since 1893. It had also organised the first anniversary of the association under the chairmanship of the principal Kees in 1894.\(^\text{31}\) With a view to keep the old and the new college students in close touch, for their own good and for the cause of agricultural progress in general, and also with the object of keeping the older alma matter in affectionate memory, a new association was formed in 1909 with the name of the Madras Agricultural Students Union (MASU).\(^\text{32}\) The Association offered membership to the students of the college and those students who passed out already from Saidapet College and Coimbatore. By


\(^{31}\) Board of Revenue, Revenue Settlement, Land Records and Agriculture, 30 July 1894, proc. no. 308, TNA

1913 the Association had 138 members and most of them were old students of the Saidapet College. The Association provided an honorary membership to zamindars and distinguished scientists who were interested on agricultural improvement. Contributions through donations were made to the union’s permanent fund. A rule was enacted admitting as a patron if the contribution made was not less than Rs. 100 but Rs. 5 to 10 was paid annually towards a general membership.

The Association was responsible for arranging annual agricultural conferences almost regularly since 1911. The Association conferences were regarded almost equalling to provincial agricultural conference both by the Heads of Departments and by the general public including press. Reasons seems to be mainly two, first they were presided over by the most distinguished persons of the time, executive council members, ministers, zamindars, scientific experts, Heads of the Departments, and Governor. Secondly high standard research papers and discussions were contributed to the conference.

Expansion of knowledge of scientific agriculture through the means of publication was important. Publication on agriculture matters was an important means to disseminate among the ryots. The use of printing machine provided large production at reduced cost and time. In addition, matter in print promoted authenticity.

Printing also enabled coloniser to rule its empire from far of distance, if colonies were occupied by using of power, but it was through print, Colony was kept under rule. Print assumed under Colonialism the roles of guard, secret messenger and also saviour of empire. And also the empire was protected, continued and controlled through print. Print was also used to establish ideological supremacy over colony through civilisation propagation.\(^{33}\)

Scientific departments under Imperial government made their works

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published either as annual report, bulletins and other farms. In the Imperial department of Agriculture, organised measures were taken for collecting and publishing information on various published sources by creating a post of official economic reporter at National Museum, Calcutta. Under instruction of the government, George Watt working as economic reporter had prepared a descriptive catalogue under the title of a ‘dictionary of economic products.’ He had reproduced into dictionary that information already recorded in some form in books, reports and journals or in the manuscript papers of government officers. It brought out into a ready reference of Indian economic products. The work had inspired the government and Watt was retained in 1887 in a permanent post for further assignment of collecting and collating new information with a view to ultimate incorporation in a revised edition of the dictionary.

On the advice of the Board of Agriculture made in its first meeting, the Imperial government accorded a sanction permitting the Imperial Agricultural Research Institute to publish two journals on experimental basis for three years but they were permanently retained after expiry of three years. Accordingly, two journals were instituted in 1906 namely Agricultural Journal of India and ‘Memoirs of Agriculture’, the former was aimed for general concern, and the latter one was dealt with purely scientific subjects. They were edited by the Inspector General of Agriculture but he was assisted by an advisory committee consisting of the staff of Imperial Agricultural Research Institute. Besides them, bulletins on special subjects were also published. The journals provided a permanent record under one cover, of the practical results of agricultural research work throughout India. The Agricultural journal of India dealt with subjects connected with field and garden crops, economic plants and fruits, soils, manures, methods of cultivation, irrigation, climatic conditions, insect pest, fungus diseases, cooperative credit, management of livestock, cattle breeding, implements. Whereas the journal of Scientific Memoirs was devoted
purely on scientific work including chemistry, economic botany, entomology, plant pathology and bacteriology aiming at informing the research workers. The results of scientific researches made both at Pusa and in the provinces were published by Scientific Memoirs. They were also a medium of communication between the officers of the several departments and were expected to appeal to the leading agriculturist.

Department of Agriculture used publications as media for spreading its works. In 31 May 1910, government of Madras issued an order requiring publication of the calendar of the department in all vernaculars of the presidency and to be supplied free to all the village officers, one copy of the calendar was also distributed to each elementary school. Seventy thousand copies were distributed in 1911-12. The calendar formed instrumental in communicating for the departmental knowledge to the educated ryot.\(^\text{34}\)

The calendar was published simultaneously in English and four local languages of Tamil, Telugu, Malayalam and kannarase. The calendar contains articles of instructing and interesting on agriculture and veterinary science and deals exclusively with the work of the department and agricultural research stations, veterinary science, pumping and boring operations, agricultural loans. The calendar was sold for a nominal price of one anna, intending to provide much useful information in the shape of notes and articles prepared by experts. Samson, Cecil Wood, Fletcher, Harrison, McRae, Hilson and Aitchson of agriculture department of Madras wrote notes on wide range of subjects on scientific agriculture. It was in the form of leaflets, information on the subjects was widely distributed. Leaflets were published in simple possible language on wide range of topics. About 1,20,000 leaflets were issued on the single planting of paddy and other subjects were covered of castration of cattle by mulling, the ill effects of communal grazing and home made remedies against some common plants pest have had a circulation of 60,000 copies. And 7,520

\(^{34}\) Report of the Madras Agricultural Department, 1913-14, p. 12.
copies of a digest, which comprised of the work done by the agricultural departments, were issued in English and three principal vernaculars of the province.

In addition, leaflets on a wide range of over 150 subjects of practical interest had been printed and distributed free. The leaflets contain hints on the cultivation of such crops as sugarcane, plantain, turmeric, coconuts, cashew nuts, tapioca, cotton, coriander, potatoes, monsoon ploughs, bone crushing mills, preservation of manure, preparation of poudrette, school gardening, implementation of Pest Act and planting tree. Bulletins were also published on the issues researched by the department of agriculture. They were priced low at few annas. Most of the issues covered in the bulletins were ranged from soil surveys, crop pest calendar, agricultural proverbs, sugarcane crop, pepper crop, groundnut crop, cholam and so on.

With a view to educate the public, the agriculture department issued a monthly digest since 1922 and were continued till 1929 when it was changed to a quarterly publication. Scientific experts made their contributions in different subjects. Their scientific writings were printed regularly in journals such as Agricultural Journal of India, The Indian Journal of Veterinary Science and Animal Husbandry, the proceedings of Indian Academy of Sciences, the Journal of Indian Botanical Society, and Memoirs of Agricultural Science.

Most important effort towards scientific agriculture was made by the journal of the Madras Agricultural Students Union, an official organ of the Madras Agricultural Students Union. The Journal had started as a yearbook in 1910 and a year later converted into a quarterly publication and finally developed into a monthly in 1914. It covered in initial period only college news, research experiences and observations, and extractions from lecturings. Over a time it was reorganised to cater to the needs of the wider public interests. The Journal kept annual subscription rate at two rupees. Besides acting as a medium for modern agriculture, it was used as an avenue to
advertise on artificial manures, agricultural implements.

But journals in vernacular languages played an important part in spreading scientific agriculture through writing in the language of the ryot. These journals carried wider percolation and had been able to reach remote villages. In Madras, Dharmanga Raju, with the help of his younger brother Ramaraju started a journal ‘Agriculturist’ intending to spread modern agriculture for Tamil ryots. The journal was started as monthly in 1910.

Despite printing cost of the journal being high, it was managed to keep annual subscription as low as 12 annas covering within it even the postal charges. When question about smallness of subscription was asked, Dharmanga Raju made a reply that “I do not care if it pays, I am prepare to put but not less than 50 rupees monthly out of my salary against loss. It would repay through those who are well acquainted with these subjects.” The journal regarded, especially for the manner of presenting these difficult scientific subjects to the lay public in popular manner. The journal ‘Agriculturist’ in November 1914 issue published a detailed account of the Agricultural College at Coimbatore, written by one mirasdar cultivator, Tirumalarayappa Mudaliar of Vellagal village, Tinnevelly district. Tirumalarayappa’s some of suggestions to be made in the Coimbatore agriculture college were “arrangements for giving lessons in theory and practice on the market, training of masteries to be employed, to handle new implements and cultivation of new crops and follow new and improved methods of cultivation, training of village munishiffs and Carnams similar to the one in village manual and of the training of village servants in farm work and imparting of agricultural instruction to village subordinates.” Besides useful articles written by experts and by the editor, the journal had published detailed replies to subscribers questions by the editor were published.

The Ellore Agricultural Association in Krishna district had maintained a journal ‘Vivasayam’ (Agriculture) a monthly in Telugu and edited by Gopisetti
Narayanaswami. The Journal had started in 1908. The Journal’s objective was “to convey information to the Telugu cultivator, on the problem of how to make land yield more than it does under existing methods and conditions.” The Journal was intended to achieve its object through “publishing matter bearing on modern methods of agriculture, improved appliances, transformation of material into manure and establishment of rural cooperative credit societies.”\textsuperscript{35}

It also published along them, useful hints on agriculture and allied topics taken from ancient books and other sources. The Journal was subscribed by the taluk board of the Vijayanagaram, Barahampur, Kakinada, Telnali, Nellore, Ananthapur, Ramallakota, Nandikotukur, Adoni, Ongole, Kandukur, Bellary. Krishna District Board of Agriculture alone subscribed of about 324 copies. The Journal was widely circulated among department officials. The Journal had received 800 subscribers and profit made through sale of the issues had fetched a chief source to the expenses of the Association.\textsuperscript{36}

Numerous articles of the journal were advocated improvement through the scientificaization of natives’ own methods. Modernising traditional system, the journal viewed as the right way for ‘guaranteed progresses and opposed any endeavours towards imitations from west. The journal emphasised the fact that mere imitation of western practices were not a real progress, and it was revealed repeatedly through editorials.

The books on modern agriculture were also published in vernacular languages. Pingali Venkaiah wrote ‘Vivasayashatram’ in Telugu. It was published by Gnanodaya library of Machilpatam. The book comprised 286 pages and was priced at 1-2-0. The book contained lessons on cereals, fibre, oilseeds, sugarcane, turmeric, dyes, and fodder crops, soils. Special attention was paid to Combodia cotton. Another book in Telugu ‘Vivasayashtram’ wrote by Kocharlakota Venkatalakshmi Narasimlu Rao Panthulu.

Contemporary journals, newspaper reports, pamphlets expressed both

colonial and Indian opinion. English newspaper, *Madras Mail* writing about improvement of agricultural practices had quoted Varadaraja Modelly, a model farmer in Varambium village in Tanjor district. Chance placed in his hands a copy of *Vavasaya Vilakam* a Tamil Manual on improved agriculture written in a clear and lucid style by G. Rajagopal Naidu, government agricultural inspector.\(^{37}\) From the close study of the book the farmer derived his main ideas and inspiration on improved agriculture. The paper further stated that bold and enterprising he was, he soon constructed on his land wells, and fitted with chrome-leather buckets for the requirements of dry crops. The results obtained were an impressive object lesson for his neighbours. Some of who began to follow his example in the utilisation of their leaf shedding for the preparation of field manure. Some of the agricultural inspectors undertook the task of translating into the vernacular. In Tamil language Seturama Iyer, an inspector of agriculture at Nidadamangalam in Tanjore district published a textbook entitled *Vivasybhodhini (Field and Garden Crops of Madras).*\(^{38}\) The book was written in easy language and cared to explain rules of cultivation with their reasons with the help of a large number of diagrams. The book considered as a useful guide for promoting modern knowledge. Seturama Iyer held the view that production of knowledge of agriculture was not a new invention of the colonial masters. Agriculture in ancient period was studied and rules were made by learned class of people in each village, which survived until the existence of village government. Those rules had been recorded as axioms in vernaculars. As they were axiomatic, the village scientist explained them to the ryot.

**Spread of Improved Varieties:**

However extension efforts of the Departmental work did not achieve


\(^{38}\) A. Seturma Aiyar, *Vivasyabhdhini*, Madras, F. A. Natesan and co., 1908.

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break through but its activities had produced some measurable effects.\textsuperscript{39} There were slight shifts in the total acreage between 1905-1928. Total acreage of food cropping in Madras presidency fell from 83 percent of total acreage to 77 percent. A more pronounced trend can be seen within the individual crop patterns. Using 1896-97 to 1900-01 as an average base period, major food grains with the exception of rice, declined in acreage, by 1931-36 from 13 per cent in the case of cholan to 17 per cent in the case of ragi and cumbu. At the same time groundnut acreage more than doubled and cotton rose by 44 per cent. The significance of these trends was two folds. Commercial crops of cotton also fed the growing mills. George Blyen, who has carried out extensive analysis of yield patterns, discovered that Madras had an annual average rate of yield increase of 0.35 per cent of food grains and 1.25 per cent of non-food grains between the years 1901-41.\textsuperscript{40}

Efforts to produce long staple irrigated cotton resulted in the development of improved Karunganni and Cambodia varieties. In the ceded districts, the northern and western varieties of cotton were refined. Uppam and Karunganni strains were selected from local Tinnevelly cotton for the southern districts. Most important success was the development of Cambodia cotton, an irrigated variety which could be grown on red soil. This was a long staple variety, which was grown with excellent results on the red soils of Coimbatore and Salem. Series of experiments conducted on Cambodia cotton plant evolved a variety, which had an American style of foliage and staple, but in place of the shallow roots of the American plant it had a long tap, which could reach down to the rather sparse moisture in the soils. It did well on red soils with a limited amount of irrigation and provided a quality of cotton that was much better than anything else produced in the region. The Buckingham and Carnatic mills at


Madras encouraged cultivating wide area by providing special premium. While it became most important variety in the Kongunadu tract where it was grown under well irrigation, it also did well on the western part.

Meanwhile in the same period the agricultural department also developed a new strain called karunganni from the local varieties in the far south. This Karunganni plant had a better staple and fibre qualities than the local varieties and could be grown of the heavy moisture-retentive block soils, without use of additional irrigation. The spinning magnates in Tinnevelly district, Harvey and Company promoted this strain from 1907 and it quickly spread through the block soils in the centre of the far south. With these new strains, the acreage under cotton expanded rapidly from four per cent total net sown area of the Tamil district in 1900 to eight per cent by 1928.41

Experiments with rice began in 1913 and the research stations produced a wealth of new varieties of plant. The increase of yields involves many other factors; however, slight upward trend in cotton and rice yields was partially the product of improved seeds and cultivation techniques introduced by the Department. In cotton, the influence of improved varieties were noticeable. By 1921-22, 3,85,000 acres or 22 per cent of total acreage was reported under imported varieties. In 1930-31 only 2,92,478 acres or 2.5 per cent of total Madras paddy was under improved seeds. There is a difficulty, however, in working from the data of the 1920-1930’s. The reported areas under improved variety developed by the department, such as company cottons, Hagari and Nandyal varieties and the rice varieties of company I, II, III, and GEB.

Acreage under Improved Varieties

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Acreage (a)</th>
<th>Paddy Improved Variety (b)</th>
<th>% (a) to Total Acreage</th>
<th>Total Acreage (a)</th>
<th>Cotton Improved Variety (b)</th>
<th>% (a) to (b)</th>
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<tbody>
<tr>
<td>1920-21</td>
<td>11,096,000</td>
<td>6,000</td>
<td>-</td>
<td>2,121,000</td>
<td>68,000</td>
<td>3.2</td>
</tr>
<tr>
<td>1921-22</td>
<td>11,280,000</td>
<td>29,000</td>
<td>-</td>
<td>1,783,000</td>
<td>385,000</td>
<td>21.6</td>
</tr>
<tr>
<td>1922-23</td>
<td>11,286,000</td>
<td>178,172</td>
<td>1.6</td>
<td>2,323,000</td>
<td>151,746</td>
<td>6.3</td>
</tr>
<tr>
<td>1923-24</td>
<td>10,518,000</td>
<td>166,169</td>
<td>1.6</td>
<td>1,628,000</td>
<td>2,63,525</td>
<td>10.0</td>
</tr>
<tr>
<td>1924-25</td>
<td>10,870,000</td>
<td>105,143</td>
<td>1</td>
<td>2,865,000</td>
<td>439,710</td>
<td>15.3</td>
</tr>
<tr>
<td>1925-26</td>
<td>11,323,000</td>
<td>122,182</td>
<td>1</td>
<td>2,888,000</td>
<td>373,668</td>
<td>12.9</td>
</tr>
<tr>
<td>1926-27</td>
<td>10,842,000</td>
<td>145,787</td>
<td>1</td>
<td>2,204,000</td>
<td>393,312</td>
<td>17.8</td>
</tr>
<tr>
<td>1927-28</td>
<td>10,930,000</td>
<td>102,457</td>
<td>1</td>
<td>2,100,000</td>
<td>315,348</td>
<td>15.0</td>
</tr>
<tr>
<td>1928-29</td>
<td>11,019,000</td>
<td>215,931</td>
<td>2</td>
<td>2,465,000</td>
<td>425,468</td>
<td>17.2</td>
</tr>
<tr>
<td>1929-30</td>
<td>11,262,000</td>
<td>245,326</td>
<td>2</td>
<td>2,475,000</td>
<td>260,187</td>
<td>10.5</td>
</tr>
<tr>
<td>1930-31</td>
<td>11,678,000</td>
<td>292,478</td>
<td>2.5</td>
<td>2,041,000</td>
<td>300,572</td>
<td>14.7</td>
</tr>
</tbody>
</table>

Note: Madras Season and Crop Reports 1920-21 to 1930-31.

In regard to the effect of improved cultivation techniques upon yield, transplantation of paddy was stressed. The advantages were in the amount of seed used for the crop. The department calculated that they could save over 300 million pounds of paddy worth about one crore a year, if they could extend the transplant method throughout the Presidency. The singly transplant method or economic transplantation was advocated only for those areas with a source of supply of water. By the Department measure, 19 per cent of area possible for economic transplantation was under the method in 1922. By 1933-34 the district of North and South Arcot, Chingleput and Chittoor had a combined total of 34 per cent of total paddy acreage under the transplant method as compared to 20 per cent in 1922.42

With the exception of rice, to which the Department devoted its attention was commercial crops, groundnut, cotton, and sugarcane. The area increased under these crops. In the case of sugar improvement, efforts were to substitute imports with developing improved methods of cultivation; rest of the commercial crops were export intended. Their high cash value was one of the reasons which the Department had concentrated on them; however they were seen to aid in gaining the confidence of the cultivators.

Spread of Improved Implements:

The Departments took itself the development of improved tools and cultivation machines. Few of such improved implements were imported from the west were often unsuited to Indian conditions. In the case of the iron plough it was found that Indian cultivators did not have a strong enough cattle. Also, implements had to be repaired in the village, which militated antagonism against sophisticated machines. In addition, tariffs upon the importation of equipment made it far too expensive for the cultivator to purchase European tools. Under these constraints, the Department planned to concentrate its efforts on the development of indigenous tools and techniques. In conjunction which private firms, the Department tried to develop new tools. Massey Parry and Co and Burns and Co, two local European firms, produced lightweight iron ploughs which the Department experimented on farms.

Experiments were made at government farms and then demonstrated before the cultivators. Implements were exhibited in local fairs and annual exhibitions for the cultivators to observe. It was general practice of provincial government to exhibit and hold competitions of implements of different makes purchased by the department. Government imported Swedish ploughs, which were distributed for trial. They exhibited good work but were suitable mainly on block soil requiring heavy work.

The efforts of the department to awaken interest among native landholders made some impact. Two of enlightened natives, Krishnaswami Mudaliyar in Shiyali in Tanjore district and Messers Sabapathi Mudaliar in Bellary shown personnel interest to spread western machines and methods in their neighbourhood and to make machines available for all cultivators. Krishnaswami of Tanjore had 107 ploughs working on his own estate and he had sold some to his neighbours. He had set up a smith shop on his estate and was making ploughs himself. 43

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43 Govt. of India, Dept of Revenue and Agriculture, Agriculture, March 1886, proc. no. 10-11, NAI.
Finding that there was a demand for them on the block soils of Bellary, Messers, Sabapathi Mudaliar, imported large number of Swedish ploughs into Bellary. After modifying these ploughs he distributed for sale in Bellary and Kurnool district. It shows he sold around one thousand ploughs. The difficulty of getting the iron ploughs repaired had not been altogether got over but he constructed a small foundry and was able to execute repair of these ploughs brought there by the ryots. It is reported that the farmers of Uravakonda village in Ananthapur district alone owned around 40 Swedish ploughs who patiently was use to carry them to Bellary (thirty miles away) to get them repaired. Some cultivators tried to get training at government experimental farms. The use of seed drill for purpose of seed sowing was not known in Deep South of the province, although it was commonly practised in the ceded districts of Bellary from ancient period.

In Tinnevelly district of deep south an experiment was tried for four years, almost whole extension effort was concentrated on pursuing farmers to seed drill sowing in place of broad casting of cottonseed. Initially farmers exhibited resistance, but it was attained success permanently. The seed drill developed in Bellary for the sowing of cotton and cumbu was introduced into Tinnevelly. Classes were arranged at various demonstration farms to teach the use of the drill. The advantage of the drill was that it made intercultivation easier and enhanced the growth of the crops. By 1919, only 7 per cent of the total acreage was cultivated by this method. It had taken the Agricultural Department seven years to introduce into the Tinnevelly district.

Experiments with water lifting machines had started through the efforts of Chatterton. Widespread construction of wells had been initiated individually as well as with the aid of the government taccavi loans. It was officially observed that the private wells constructed by the cultivators were usually inferior and also resulted in the financial burden.
To encourage extension of well irrigation and to reduce cost of construction of wells, and to dig at places there were few, director of agriculture department suggested to the ryots to sink well with the help of departmental officers. Well digging usually was conducted by the ryot under speculation. As the ryot was unaware of strata of the earth he was to excavate through, the existence of spring, the depth at which they exist and the nature and quantity there of available for supply, until the actual condition was complete. The ryot was suggested to make a preliminary trial of the spot by boring before the actual construction of the well was to start for avoiding any possible risks. 44

Experiments were conducted by the Department for extracting underground water by boring deep with the manual or power operated drill machine. Chatterton, director of the Department of Industries originally conceived the idea of irrigating dry tracts by using the deep underground water by using tube well. This new technique was borrowed by him from the French Administrating Pondicherry. It was promoted officially since 1906 through establishing pumping and boring branch in the department of Industries. By 1916, the department had acquired thirty-three hand drills and four power drills. The later ones were especially used for dealing with deep boring and rocky strata. Up to March 1916, 3,333 borings had been constructed, aggregating to 26 ½ miles of depth, of these, results yielded positively were 2,160 borings. 45

The traditional mechanism and machines of lifting water was also subjected to transformation. Difficulties of lifting of water were purely mechanical tasks rising of a certain weight to certain height at rate cheaper. These various difficulties were to be resolved by the help of engineering science.

44 Madras Agriculture Calendar 1917-18, p.24.
45 Ibid.
In order to deal with the lifting up of water by using newly introduced oil engines and pumps, department extend technical service to the ryot by advising him on the installation of suitable engine and pump and undertaking the erecting work as well as rectifying through periodical inspection by their own departmental staff. In order to assist the ryot in this work, eight supervisors had been appointed at different places in addition to them there were forty masteries and eighteen foremen mechanics assisted work in various divisions. The number of engines was increased to six sets for testing purpose and eight sets for periodical hiring. With help of oil engines, ten to fifteen acres were irrigated in parts of Chingleput district. In the Divi Island in the Kistna district, the largest engine and pump set was erected with a capacity of over 570 cusecs. The establishment consisted of an installation of eight diesel oil engines, each of 160 brake horse power and each driving a 39 inch centrifugal pump irrigating an area of 40,000 acres of paddy crop.

When an engine and pump had been purchased by the ryot, installation of the engine was carried by the trained supervisors of the Department of Industries for a charge of 2½ percent in the capital cost. Work of the installation of engine was carried by the ryot either by supervisors of the department of industries or through locally available fitters. Locally existed fitters usually charged less fees initially but extras money were always charged during the course of work and due to inadequate amount of intelligence and skill work frequently lead to disastrous results. On the other hand, ryot’s engine and pump sets were also supervised by of the departmental subordinates, for annual fee of fifteen rupees. The defects in the machinery were rectified during the periodical inspection of the subordinates. The ryot was taught as to the most economical and efficient ways of maintaining his plants.

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However, the introduction of power driven lifts originated many other new changes. The use of oil engine in place of bullock power impacted a reduction of cattle thereby supply of cattle manure, which was of great value in maintaining mechanical texture of the soil. Moreover, the area expanded under irrigated cultivation with use of power water lifts introduced more intensive farming which again required more manure supply. Thus, besides opening of the above improvements, engine laid long-term ecological changes of farming land. The development of the use of the machinery has led to an increased demand for trained drivers to run the engines. There remain other aspects of the question, an engine however simplified remains a very complicated affair when compared with a mhote, and it needs proper care and attention. The installation of an engine and pump implies the expenditure of a fairly large sum of money in the actual practice of the plant. The number of bullocks from which he can obtain manure was lessened, while at the same time the demand for the manure was increased.

Work was also taken up for improving animal power water lifts. Water lifting devices used by the ryots regarded as rough, inefficient, inaccurate and imperfect. Improvements pushed forward the long stagnating indigenous techniques.

The traditional lifts in use were roughly constructed. Mhote was important device commonly employed for removal of water from well by bullock power. Its importance in lifting water induced much of attention employed by the innovators. C.K. Subba rao, assistant Director of Agricultural Department who devoted much time and energy to this question and had produced an improved mhote called Subba Rao mhote in which the power of the animal was utilised by means of oscillating platform, from end to end which bullock was walked. The work was being to walk up an inclined plane and turn around at the end. It was efficient but unless made well, suffers from loss of mechanical efficiency.
In the single mhote type the animals exert their force by moving down a comparatively flat incline, usually at a slope of about 1 in 5, lifting behind them the bucket which discharges by means of ingenious tail. The bullock back up the slope until they reach the top by which time the bucket will have again reached the surface of the water. Whereas double mhote, the slope was made much steeper, 1 in $3 \frac{1}{2}$ and the animals were unyoked at the bottom of the ramp and return walking up a path at the side. Meanwhile the bucket descends into the well by its own weight, pulling up the driver who accompanies the returning rope to the top, where he fastens it by a simple loop a peg to a second pair, which would be waiting there. It was commonly practised in Bellary district. By the fact of cattle were not backup the ramp, use of much greater sloped ramp allow to use more effectively the weight of animals and big bucket therefore be lifted by the same size of cattle.

The bucket used in mhote was usually made either of leather or iron. The most ingenious and simple of all is the common leather mhote consists of a roughly hemispherical leathery bag, suspended from an iron ring and fitted at the bottom with a leather trunk or discharge pipe, the end of which was held by a separate rope above the level of the water in the bag, while the latter was being drawn up the well. Of the iron bucket fitted with valves various forms have been proposed, but the only one, that has obtained any vogue, was that used with the Sultan water lift; a cylindrical in form with a flat bottom in which was placed a large flap valve opening upwards when the bucket enters the water and kept closed by the pressure of the water on it during the ascent till at the top valve is raised by a system of levels.

Archimedean screw was exceedingly efficient for lifts, and had been introduced in parts of kistna district for lifting water on to the lands just above ordinary irrigation level. It consists of a cylinder, one end of which was made to dip under the surface of water. Within the cylinder was a special portion, the effect of which gradually to screw the water upwards when the cylinder was
rotated. The screw made were of different sizes of 5 to 9 feet long and can be used to lift water to heights of 2 ½ feet to 5 ½ feet. A 6 feet machine can irrigate nearly an acre of land with 6 inches of water in 6 ½ hours if the lift is below 3 feet. However machine required 2 to 3 men to work on them. The manufacture of the Archimedean screw lift for irrigation was taken up by private firms in Tanjore and Trichinopoly.

Chain pump was another simple and inexpensive method of raising water. It was found suitable to the native agricultural requirements especially at places where water level was not more than twelve to fifteen feet below the surface. It worked on the principle of Persian wheel, except that instead of being lifted in cups, the water is pulled in pipe by leather washers fixed on an endless chain. The chain was prevented from slipping, by engaging in special grooves cut in the wheel.

With the introduction of the taccavi loan system the spread of the improved implements found more favour with the ryots and to a large number of them took advantage of this provision. Improved varieties of crops and improved breeds of animals were developed.

Conclusions

The Government felt the most advantage method of extension was through the development of agricultural associations. On the government instruction the department of agriculture sought out the influential farmers to organise District Agricultural Associations for demonstration and distribution of improved seeds. But the government designation of influential was often formed by political exigencies and not by farming abilities. District Agricultural Associations generally were run by the more politically minded who often had little interest in agricultural improvement consequently had little impact.
Perhaps another significant factor which may be said responsible for halting progress of agriculture science was colonial assumption of hoping the big landlords and zamindars in helping agricultural science in filtering down to the smaller ryots and tenants. The colonial government act for top down spread of science was emanated from not only as an economic measure but also was included as a building up of political base among the big landlords. Accordingly some of these big landlords successfully acquired improved methods and techniques for themselves, but they ignored the colonial expectation to do filtering down the same to the smaller ryots and tenants. The improved agriculture percolated among the big landlords and zamindars had confined to them as most of them actually absentee landlords showing little practical interest, who themselves were settled fully in urban profession either as lawyers, judges or magistrates. Unlike entrepreneur landlord in Europe, increase in their wealth was not directed to reinvestment on land improvement and purchasing agriculture equipment but was found themselves attractive to more easy means of lending high interest rated loans. Some rich ryots still had desired to propagate exotic seeds and implements, but numerically they consisted insignificant number such as Mudaliar of Shiyali, Sabapathi of Bellary, Zamindar of Pithapur.