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ARTICLE

Institutionalization of agricultural education in the nineteenth century colonial India: its imperatives and models

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Abstract
The industrializing nations in the nineteenth century witnessed the expansion of the dominion of new knowledge which was formally produced within institutional sites such as universities, laboratories, academic societies, colleges, museums and many more. These institutional forms were instrumental in the production and dissemination of this knowledge. This new knowledge form not only generated new technologies for modern industries, but informed conventional forms of agricultural practices, transforming it from subsistence forms of agricultural production into cash cropping, shifting from the use of organic manure to synthetic fertilizers and from mass selection to plant breeding. The scientific development of agriculture and the dissemination of new agricultural practices paved the way for the institutionalization of agricultural education. The history of this process in the colonies was inflected by colonial rule, as the ignorance of local agricultural practices conflicted with colonial interests of the maximization of profit through agriculture. The present paper commences with an overview of scientific agriculture and agricultural education in the western world, followed by relationship of colonial state with Indian agriculture and its imperative for introducing scientific agriculture in India.

Keywords Scientific agriculture · Agricultural education · Colonial state · Indian agriculture

1 Introduction

The global flow of knowledge in the realm of agriculture in the colonized world could be traced to the inception of colonialism across the world. The reception, contestation and adaptation of knowledge in colonies was embarked through two processes; firstly the transmission of ideas and secondly by organizing varied institutions for this transmission. Indian Agriculture offered the immense opportunities to the colonial empire to introduce new ideas and institutions in colonial India; whether in the realm of revenue administration or application of science for catering the commercial interests of the empire. 'The idea of Improvement' in agriculture as argued by Richard Drayton was closely associated with the development of natural science especially botany and moved outward from its metropolitan base at Britain to its colonial territories overseas. By the late eighteenth century Britain's 'ideology of improvement' was enmeshed with state policy, reflected in Britain's enterprise in agriculture (Arnold, 2005a, 2005b; Drayton, 2000).

Transfer of useful plants, a movement facilitated and coordinated by botanical garden across the bourgeoning empire was intended to promote British commerce and manufacturing. The network of people, institutions and information became central in the exchange of knowledge and ideas, this flow not only addressed the mercantile interests of the empire but the process has its own impetus, characteristics and constrains (Arnold, 2005a, 2005b; Baber, 2001; Bayly, 2000).

The idea of improvement dominated the British agricultural enterprise through-out the nineteenth century, however the form, content and the agency for manifesting this idea was different during the pre-Victorian and Victorian period in colonial India. Botanical Garden at Kew became the prime centre for exchange of commercial and exotic plant varieties between England and colonies. This enterprise was effectively carried out by establishing its appendage in Calcutta in 1786 i.e. the Calcutta Botanical Garden. The successive directors of Kew Garden namely Joseph Banks, William Hooker and Joseph Hooker nurtured and disseminated the idea of improvement in support of British commerce and

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manufacturing (Arnold, 2005b; Brockway, 1979; Drayton, 2000).

With the expansion of company rule in southern and some parts of the northern India by the early nineteenth century, the idea of improvement was promoted by constructing the deficient narrative of Indian agriculture. Colonial officials and European travelers explored the British Indian territory for varied reasons. The exotic and romantic description of British territories by officials and travelers like Francis Buchanan's inquiry of southern India in 1800, Bishop Heber's description of Delhi in the mid 1820s, James Tod journey of Rajasthan in 1820 and F.J Shore reporting of western Himalayan in 1827 facilitated the British conception for agricultural improvement (Arnold, 2005a, 2005b). Nair argues that scientific development in colonial India is inclined towards centre-periphery dichotomy to explain exchange of knowledge between colonizers and colonized; this overlook the nature of practice which is a combined effect of social, scientific and power relation. Raja Serfoji II (1798–1832) of Tanjore effectively established the conduits of scientific knowledge with west and at the same time collected natural scientific information as a means to build his own scientific enterprise to contest colonial modernity (Nair, 2005).

By the late nineteenth century the idea of improvement drove the attention of British Indian state towards agriculture; as the outbreak of recurrent famine posed severe challenges to the commercial returns from agriculture. The colonial government for the first time inquired into the problems of Indian agriculture by setting up the famine commission (1880) and subsequently seeking the assistance of agricultural chemist J.A. Voelcker (Kumar, 1995; Randhawa, 1983; Sen, 1991). Voelcker examined the causes of impoverished state of Indian agriculture and laid the responsibility to the British government to improve Indian agriculture through scientifically managing the land and introduction of science of agriculture by training and educating farmers. Under this foreground, the imperial government on the one hand felt the need to appoint scientific personnel to assist Indian agriculture and on the other attempted to frame policy with regard to agricultural education. The conception of agricultural education in colonial India had impression from the developments that was taking place in England and elsewhere in the western countries. In the backdrop of Voelcker Report, present paper disentangle 'the idea of improvement' in agriculture manifested in the latter half of the nineteenth century through the establishment of Experimental farm and the colonial state's enterprise for agricultural education.

The paper has examined the case of Cawnpore (Kanpur) Experimental farm and Cawnpore Agricultural School established in 1874 and 1893 respectively. This farm became the prime centre for disseminating new methods, manures, seeds, crops and implements in the region. Cawnpore farm was chosen by Voelcker to examine the state's effort to improve agriculture, moreover the farm was situated in the most fertile region of Ganga-Yamuna doab of northern India. The paper has examined the nature and utility of these enterprises and its encounter with local agricultural practices. Further, the idea of improvement was manifested through the institutionalization of agricultural education. The policy for agricultural education was centered on the application of scientific method in agriculture which began to appear in government document from 1880s onwards. Nevertheless the attempts made by colonial government were confined to management of experimental farm, revenue administration and spreading scientific methods for encouraging the production of cash crops (Jolepalyam, 1990; Stokes, 1975). Political will and political economy of the state did not allow the colonial state to apply scientific methods for improving the condition of Indian tillage and subsistence agriculture. Consequently government policy for agricultural education did not take firm direction whether at the level of its structure or pedagogical content. Nonetheless, by the end of the nineteenth century agricultural education had firmly established in Western Europe and in the United States of America, however in Britain the state was gradually recognizing the significance of agricultural education.

The paper initiates its discussion by tracing the history of science and its application in modernizing agriculture in the west. It further examines the process of the development of agricultural education against the development of natural sciences in the west and subsequent shift in agricultural practices in Europe and America. Moreover a critical examination of role of state, science and educational enterprise in the realm of agriculture in the west and colonies help in understanding the process through which the discourse of agricultural education was shaped and the dynamics of institution building took place. The second part of the paper examines the state enterprise in improving agriculture through the case of Cawnpore experimental farm and Cawnpore Agricultural School. Experimental farm and agricultural school represented the pedagogical apparatus adopted by colonial state to improve the Indian agriculture, although restrained by colonial imperative for maximizing profit and establishing the dominance of western knowledge in the realm of agriculture.

2 Science and agriculture in the west

By the turn of the eighteenth century economic botany had emerged as the official science of the colonial empire facilitating the collection and classification of the world's plants and introducing new species in favourable environment for economic benefit. Mass culture, pedigree culture and then plant breeding and hybridization paved the way for

improved methods for developing better varieties of plant crops in specific ecological zones. Consequently, by the mid nineteenth century experimental farms had emerged as fields for carrying out new experiments. Botanical gardens were endowed with experimental farms for studying specific crops through the lenses of specialist sub-disciplines i.e. plant taxonomy, physiology, pathology, entomology, chemistry and soil science (Headrick, 1988).

The taxonomy of plants was by itself not of great advantage until and unless the ecology and physiology of plants were as not discovered. However, by the mid nineteenth century, it was in chemistry rather than on the biological and mechanical sides where science made its most effective contribution to agriculture. The pneumatic revolution in chemistry, beginning with Priestley[1] (1733–1804) and culminating in the work of Lavoisier[2] (1743–1794), revealed the energy mechanisms of living organisms and that animals derive their energy from organic food produced by plants that fix the solar energy in plants. This did not result in a breakthrough in agricultural production. Meanwhile, by the first half of the nineteenth century Justus von Liebig's[3] (1803–1873) classical investigation conducted at the request of British Association and compiled in his report "Chemistry and its Application to Agriculture and Physiology" explained the division of living tissue and the classification of food into carbohydrates, fats and albuminoids (protein). This paved the way for the application of chemistry for agricultural production. The recognition of the existence of biomolecules of plants helped in understanding the composition of plant nutrients which could be artificially supplemented in the soil for agricultural production (Bernal, 1954).

Sir John Lawes (1814–1900), a gentleman of scientific taste turned his estate at Rothamsted, England into the first agricultural research laboratory where he experimented with nitrates, superphosphate and potash from various sources as substitutes for farmyard manure and even erected factories to produce them.[4] These scientific efforts led to the establishment of the fertilizer industry in the late nineteenth century. The industry served dual objectives. The fertilizer industry became the prime mover for surplus agricultural production. Further, the chemical industry supplemented the needs of textile industry which subsequently paved the way for heavy chemical industry ready to supply the war needs of the twentieth century (Bernal, 1954).

Chemistry in England, however, was still the pursuit of few amateurs and even fewer academic university departments in the mid nineteenth century, while chemistry was being promoted in Germany by effective research collaboration between academia and industry as evident from the proliferating dyestuff industry (Thurow, 1982). Perkin's[5] discovery of aniline dye, neglected in Britain, was taken up immediately by the more scientifically oriented directors of German industry and profits rapidly accrued from synthetic dyes. The chemist at the end of the nineteenth century was effectively a new kind of scientist, closely tied up with industry (Donnelly, 1996). Meanwhile, by the mid nineteenth century, Germany had recognized the importance of modern science and generously provided funding for building scientific institutions. During this period, Leibig's Mineral Theory for plant nutrition had replaced the pre-existing Humus Theory. This revolutionized the agricultural research and placed organic chemistry at the centre of modern agriculture practices (Randhawa, 1983).

3 Agricultural education in the west

Initiation of agricultural education in the west can be discussed under three models of agricultural education that emerged in Britain, France and the United States of America, each with its distinct characteristics. France had developed a very elaborate system of agricultural education starting from the primary to the higher levels. In Britain agricultural education was in private hands until the turn of the nineteenth century and the United States presented a unique model of agricultural education in the form of Land Grant Universities that was emulated by many countries.

[1] Priestly was born in Yorkshire, England and trained in philosophy, science, language and literature at Dissenting Academy at Daventry. He discovered oxygen in 1774 by heating red mercuric oxide and called it 'dephlogisticated air' based upon the belief that ordinary air became saturated with phlogiston once it could not support combustion and life. https://www.britannica.com/biography/Joseph-Priestley 3/11.

[2] He was a French scientist. His initial training was in law but due to his interest in chemistry and physics, he dedicated his life for research in chemistry. His long experiments in chemistry replaced the phlogiston theory with oxygenation theory. https://www.britannica.com/biography/Antoine-Laurent-Lavoisier.

[3] He was a German chemist, widely acclaimed for the development of analytical organic chemistry. Considered as the father of agricultural chemistry. http://www.newworldencyclopedia.org/entry/Justus_von_Liebig.

[4] John Bennet Lawes and G.H. Gilbert examined the effect of different fertilizers on crop which led to the formation of first Experimental Station at Rothemsted in 1843. Lawes a determined businessman and Gilbert a dedicated scientist together worked for 57 years leading to 300 published papers and scientific letters. See Catt, A. John and Henderson, Ian F. 1993. "Experimental Station 150 Years of Agricultural Research the Longest Continuous Scientific Experiment". *Interdisciplinary Science Reviews 18(4)* pp. 365–78.

[5] William Henry Perkin (1838–1907) synthesized mauve or aniline purple- the first synthetic dyestuffs discovered from chemicals derived from coal tar. See https://www.chemheritage.org/historical-profile/william-henry-perkin.

Agricultural education in France had been initiated from a very early stage by integrating instruction in science and orienting children to village life. Agricultural education was imparted in all rural primary schools from 1879 and subsequently became obligatory after the inclusion of agricultural education in Teacher Training Colleges (Normal Colleges). In primary schools instruction was based on observation of everyday life and illustrated through experiments. The primary objective was to inspire students to appreciate country life, liberty and industry, associated with agriculture. In higher primary schools, which were district schools, the agriculture section was added in 1893. The aim of instruction according to M. Combes was that:

> the field labour is not deficient in intelligence, energy or love of work; what he lacks is knowledge of laws of nature. The agriculture courses, therefore, makes it its special aim to teach these laws, and especially to instill into the mind of its pupils scientific notions which they could never acquire at home (Medd, 1899).

Hitherto, this general system of agricultural schools, instituted from 1875 a chain of specialized Practical Agricultural Schools like the Practical School for Poultry farming at Sauvic near Havre founded in 1894 and Poligny Practical Dairy School at Jura, a prominent cheese making district, founded in 1892, were a few examples (Medd, 1899).

France also had a sound system of instruction in farm management at the National Agricultural School, whose aim was 'to raise the educational standards of the rural landed proprietor and farmers to such an extent as to render them expert and enlightened agriculturists, capable of managing the farm profitably' (Medd, 1899). A more distinguished characteristic of these schools was that greater prominence was given to those subjects that were of local importance, for example, at Grignon special emphasis was accorded to artificial pasturage, the cultivation of cereals, the cultivation of different kinds of fodder and industrial crops.

The Institut National Agronomique was the institute for advanced agricultural education located at Rue Claude Bernard, Paris and the aim was to produce agricultural professionals such as agriculturists or landed proprietors, managers of private or public undertakings, professors of agriculture for teaching in National and Practical agricultural schools and departments, directors of agricultural stations, and agricultural chemists (Medd, 1899).

Thus, the French system of agricultural education provided skilled manpower according to the varied needs of modern agriculture ranging from farming to land management to specialized agricultural industry to agricultural professionals. The system was coherently designed for various stages: commencing with everyday facts to theoretical and practical scientific knowledge. The system was open for progressive learning and the student could opt out voluntarily and engage in productive work. Moreover, the introduction of agriculture at the primary school level assured the pupil's association with country life.

By the mid nineteenth century in the United States of America, the state of Michigan made provisions in its constitution for the establishment of an Agricultural School and State Agricultural College in 1858. In 1857, Justin Morrill (1810–1898) of Vermont, first introduced measures for the endowment of Agricultural and Mechanical Colleges (A & M Colleges) in several states by the federal government. Subsequently, the epoch making Morrill Act paved the way and Abraham Lincoln in 1863 announced, "the new birth of our new soil" (Brown, 1908). The Morrill Act of 1862 ensured aid to the states to pursue higher education in the domain of agriculture and mechanical art (Brown, 1908). The prime objective of the Land Grant[6] policy for agriculture was to impart training in scientific agriculture, and to bring the new knowledge in contact with the real work of the farm and to produce teachers for elementary and secondary schools. Clark Kerr argued that the Morrill Act is a legal framework which ensured democratization of universities (Kerr, 2001).

Back in England, in 1831 the British Association for the Advancement of Science was formed by Charles Babbage (1792–1871). The Association requested Justus von Liebig to prepare a report on Agricultural Chemistry; this catalyzed the application of modern science with regard to soil science and nutrition (Randhawa, 1983). In 1890, the Royal Agricultural Society, England came into being which popularized scientific methods of farming among farmers. Prior to this, in 1845 Cirencester (later Royal) Agricultural College was founded in England where students were trained in scientific agriculture for propagating modern methods among farmers. All these efforts resulted in a movement among farmers, the slogan being "Practice with Science" (Randhawa, 1983). The college offered courses in Indian and colonial agriculture and many of the diplomats went abroad. The courses and practices adopted by the college were emulated by Agricultural colleges started in England as well as in colonies (Cheesbrough, 1966).

The efforts made in England were confined to private enterprises and it was not until an additional tax on beer and spirit was imposed in 1890s that created a Whiskey

[6] On July 2, 1862, the United States' Congress passed a bill granting to each state 30,000 acres of land for each senator and representative in congress for the purpose of endowing institution for teaching such branches of learning as are related to agriculture and the mechanic arts. This gave great impetus to the cause of technical education. The institutions formed through this endowment were referred to as Land Grant Universities. See Washburn, Charles G. 1906. "Technical Education in Relation to Industrial Development". Science New Series: 24(604), pp. 97–112.

Fund which was allocated for the promotion of technical education. This led to the foundation of the Agriculture Education Association in 1894. Agricultural education was grounded in institutions like the South Eastern Agricultural College, Wye, Expansion College, University of Reading; a diploma examination at Cambridge. These institutions were organized by government for strengthening the higher agricultural education in England. The Board of Agricultural Act (1889) created a department dedicated for the interests of agriculture and the act stated:

> Prosperity must be brought back to farmers not by any action of Parliament, not by the fostering care of department, but by bringing home to them that knowledge and power by which they themselves work out their own deliverance (Richard, 1988).

The dissemination of knowledge became a buzz word for agricultural colleges which was rightly reflected in the work carried out by the South Eastern Agricultural College, Wye. The College was located in the countryside with provision for peripatetic (mobile) tuition around the counties with formal lectures and instruction in dairying, fishery, poultry, bee-keeping, and the establishment of chemical testing and seed control laboratories for local farmers (Richard, 1988). It is worth mentioning here that initially the college was not welcomed by farmers as it was felt that there was nothing to learn in agriculture. The persistent efforts of Daniel Hall (1864–1942) popularized the college among farmers and he became the chairman of the farmer's Canterbury Club. The success of the college was not merely reflected through the publications and instruction but a warm relationship was established and maintained with its farming community.

Agricultural education by the late nineteenth century had been institutionalized in specialist institutions, but the majority of them were under the Department/Ministry of Agriculture. Consequently, any state in which agricultural education was initiated, the institutions developed and the curricula offered was determined by the state's need for workers trained in agriculture and closely related activities. The department would also dictate the curriculum and course content in terms of the demand of the students prepared to do work (Works, 1930).

In contrast to this, educational institutions could define their vision and prepare the curriculum without regard for the local needs of society. This could be reflected in the teaching or methods that had little or no economic or social significance for the areas served by them. The point is that agricultural education was quite different from general education as local society expected too much from it, but where content and methods were swiftly changed by educationists, keeping the larger interests of society as their prime concern.

4 The agricultural enterprise in colonial India

The following discussion unravels the complex interplay of various events that shaped the discourse on agricultural education from 1870 to 1905. Reflecting on the complex nature of agricultural education that emerged in the second half of the nineteenth century in Europe and the United States of America, it is evident that the situation was more complex in colonial India, beyond the profit motives of empire complexity in agricultural education arose from the internal structure of agricultural education, the colonial encounter with local knowledge systems and the debates concerning resources to be invested in agriculture and education. An analysis of the internal tensions within the ruling classes in a colonial context and treating metropolis and colony as a single analytical field throws light on the fluid nature of the relationship between colonizers and colonized (Stoler, 1989; Stoler & Cooper, 1997).

The organization of agriculture as an enterprise was initiated in the 1870s with the efforts of Governor General, Mayo (1869–1872) who extended irrigation and railways to enhance the acreage of farming and the rapid transport of raw materials to ports from the fertile interiors of British India. A Department of Knowledge and Statistics was established by the Government of India for collecting information about the country and its people by systematizing the information in District Gazetteers. In the realm of agriculture, the problems of famine and soil infertility persisted and Mayo felt that these could be managed by systematizing the knowledge about man and nature of this land (Randhawa, 1983).

Neither the Bengal famine of 1866, nor the recommendations of the Famine Commission formed in its aftermath directed the attention of the colonial government towards the pathetic condition of Indian agriculture, rather it was the British trading community that was struggling to procure cotton due to the American Civil War, which forced the British Indian Government to take necessary steps for improving the cultivation of cotton by organizing a separate Department of Agriculture. The Cotton Supply Association of Manchester petitioned the Secretary of State in a memorandum dated 12 March 1869 to explore ways and means to improve the supply of cotton from India to the textile mills of Manchester (Alvares, 1991).

Notwithstanding these proposals, the Secretary of State approved the recruitment of an additional Secretary to the Government of India in charge of the new Department of Revenue, Agriculture and Commerce in 1871. No scientific officer was appointed, either in the imperial government, or in the provinces. The Department functioned merely as an information gathering agency rather than introducing any programme for the scientific improvement of Indian agriculture (Randhawa, 1983). Moreover, the casual attitude of the colonial government was reflected in the manner in which

the department was organized by placing more importance on revenue than on agriculture and entrusting the department with miscellaneous subjects from the three great divisions of the Administration; Finance, Judicial and Political, with which they did not care to deal (Voelcker, 1893).

The only province which moved forward for establishing the agriculture department was the North Western Provinces of Agra and Oudh (United Provinces) which established a Department of Agriculture in 1875. The department was organized with the efforts of John Strachey (1823–1907), Lieutenant Governor of the province, who had been a member of Mayo's Government and was of the view that substantial development could only come from a provincial department of agriculture and not from the government secretariat (Royal Commission on Agriculture RCA 1928). Extensive work on irrigation and cash cropping in the province demanded the organization of such a department for better control and supervision. Edward Buck was appointed the first Director of the new department and his prime function was to collect and organize statistics for trade and agriculture for 5 years (Voelcker, 1893).

Thus colonial policy for agricultural development was overwhelmed by administrative establishments for smooth and effective revenue administration, rather than, for scientific agriculture. The officials, who were recruited, neither had the knowledge, nor the time to invest in agricultural improvement. Moreover, the department was short of finances to take constructive steps for teaching or research in agriculture. Even though, Mayo appointed Allan Octavian Hume (1829–1912) as the Secretary of the new Department, the former's demise in 1872, deprived Hume the patronage of an empathetic Viceroy. Subsequently, under the Viceroyalty of Lytton in 1878, the department was reabsorbed in the Home Department and Hume was transferred to the Board of Revenue at Allahabad (Randhawa, 1983; Voelcker, 1893). Reflecting on the efforts of the colonial government with regard to agricultural improvement A.O. Hume observed:

> the sufferings of the Indian masses from famine and diseases arose from poverty and this poverty was preventable, if the Government would take into their counsels experienced representatives of the people who know exactly where the shoe pinches (Randhawa, 1983, p. 185).

No significant development in scientific agriculture had taken place from 1870 to 1880 in colonial India. In contrast to colonial enterprise for modernizing agriculture, the Princely state made deliberate efforts to improve agriculture. As argued by Unnikrishnan, the institutionalization of modern scientific agriculture and its popularization was part of a larger process of social and intellectual change in the nineteenth and early twentieth century in Kerala (Unnikrishnan, 2021). The government of Travancore not only made attempt to popularize science through vernacular periodicals but also established agricultural demonstration farm and schools for the same. However, Baksi found that by the late nineteenth century there was very little writing on the application of the modern science and technology in the process of agricultural production in Hindi. However, Provincial Government and Agriculture Department of United Provinces facilitated the publication of agriculture related periodical like *Hal* in the latter part of the first half of the twentieth century. Nevertheless, popular Hindi periodicals like *Vigyan, Saraswati, Madhuri, Maryada, Vishal Bharat, Sudha, Veena, Ganga* started publishing articles on Science by the early decades of the twentieth century (Baksi, 2016). The government of the princely state readily recognized the need for popularizing science for agricultural improvement in vernacular whereas colonial state was overwhelmed with commodification of agricultural product.

The Government of India Resolution of 1881 clearly admitted that the objective of the department created in 1871 completely revised the objectives framed by Mayo. Meanwhile, the Famine Commission of 1880, while inquiring into the depressed state of Indian agriculture reiterated the need for the establishment of a separate department of agriculture in each Province by the Imperial Government. Subsequently, the Department of Revenue and Agriculture was reconstituted at the centre and in the provinces in 1881. The provincial departments were referred as "Department of Land Records and Agriculture" and were assigned the function of maintaining agricultural information, preparing and examining land records and village maps (Voelcker, 1893, pp. 2–3). Edward Buck was promoted to the Imperial government from the North Western Provinces and became the first Secretary of the Imperial Department of Revenue and Agriculture. The departments which were organized at the centre and the provinces were bureaucratic in nature and were concerned with raising revenue collection, yet the Secretary of State inquired about the expenditure of the new departments in 1886. The Government of India informed the Finance Commission of 1887:

> Imperial and provincial departments were organized on purely financial grounds, and quite apart from any indirect benefit that might have accrued to agriculture, their establishment had been amply justified, and had resulted in a considerable increase of revenue to the state (Voelcker, 1893, p. 3).

But the words fell on deaf ears and the subsequent demands made in every alternative year from 1882 to 1888 by the Government of India to the Secretary of State for the appointment of agricultural chemist was declined on the grounds that the Secretary of State was not satisfied with the manner in which the recommendations were made. Meanwhile, in the North Western Provinces, where cash crops and

food grains were a substantial source of revenue, agricultural conditions began to deteriorate in large tract of the province, which forced the imperial government to seriously look into the problem. In 1882, the Government of India proposed the appointment of Agricultural Chemist and the proposal clearly stated the agricultural problem:

> .....there were large tracts of land, especially in North-Wesern Provinces, which were uncultivable on account of the presence of noxious salts, and it was thought that science might aid in reclaiming these lands. There was also a further intention to utilize the Agricultural Chemist for educational purposes (Voelcker, 1893, p. 4).

The proposal was now rejected on the grounds that matter was a provincial not imperial one. The indifference of the Government in London to the agricultural backwardness of the country impeded the development of agriculture in comparison to western countries where science was making great strides in the art of cultivation. The Delhi Agricultural Conference held in 1886, recommended the appointment of at least a first class Agricultural Chemist for India and had urged that the employment of such a man in connection with the expansion of the Forest School at Dehra Dun and the College of Science, Pune would be desirable for educational purposes, his time when not engaged in the actual work of teaching being devoted to agricultural inquiry. These recommendations were sent on 21st June 1888 to the Secretary of State, but were returned to the Government of India seeking more explanation. The Government of India felt that the financial situation of the government was sound and the time had come to work upon other recommendations of the Famine Commission regarding agricultural improvement. Subsequently, the Government in its reply to Secretary of State in 1889 pointed out in detail the various classes of natives for whom education in agriculture was desirable and underscored the significance of scientific inquiry in agriculture. Nevertheless, the Secretary of State was reluctant to accept any recommendation regarding agricultural education, but approved the appointment of an Agricultural Chemist.

The first serious attempt towards the modernization of Indian agriculture through the application of science was possibly the appointment of Dr. John Augustus Voelcker, Consulting Chemist to the Royal Agricultural Society, England, as the Agricultural Chemist to the Government of India. Voelcker joined his services as Agricultural Chemist to Government of India in 1889 and started visiting Experimental Farms across India, to acquaint himself with varied agricultural conditions across the country. He selected Cawnpore district in the North-Western Provinces for his field study (Voelcker, 1893, p. 7). He visited the district repeatedly to systematically follow in one locale the progress of various field crops in different stages of development. The following section will discuss the views of J.A. Voelcker on scientific agriculture and agriculture education which is the prime concern of this paper.

5 The agricultural enterprise of the provincial government at Kanpur

In Northern India, the region covered by Ganga-Yamuna doab was one of the most fertile regions and its soil was representative of large agricultural tracts in the United Provinces (Voelcker, 1893, p. 483). This led colonial officials to initiate and organize efforts with regard to agricultural improvement. Experimental and demonstration farms were established by the government in agriculturally representative and fertile regions in different parts of the country to accelerate experimentation on soils, manures, seeds, implements and crops. Demonstration farms were intended to showcase the results of successful experiments to cultivators, and in the long run were remunerative for the government. The farm carried out experiments for developing best practices for agriculture and required a substantive expenditure by the government. Some of these farms had the twin responsibility of carrying out experiments as well as demonstration, whereas some farms were either experimental or demonstration farms. The farms were established at places which were easily accessible to the administrators and experts on the one hand, and on the other, close to rural areas so that the farm could function as a useful resource for instruction to the cultivators.

Cawnpore Farm was established in 1874 through the efforts of John Strachey and in the subsequent years was supervised by Edward Buck, J.B. Fuller and Colonel Pitcher. The Farm offered an excellent location for government officials to initiate an enterprise for modernizing agriculture, enabling officials to obtain information about native methods of cultivation before they attempted any reform or improvement on their own (Buck, 1907). The processes bore a formal analogy with the introduction of western medical education wherein the Native Medical Institution (NMI)[7] offered instruction in *Ayurvedic* and *Unani* medical systems alongside the western medical system. Moreover, instruction in NMI was imparted in the vernacular (Sen & Das, 2011). Whether in the realm of general or professional education like agricultural, medical and technical; colonial officials initiated their endeavors by adopting and understanding the native system and then introducing the modern one? This entailed the need for domestication of science which involved the reorganization of traditional system against the

[7] The Native Medical Institution was established in 1822 at Calcutta where medical teaching was imparted in vernacular.

backdrop of modern scientific-technological system and thus configuring the new pedagogic system to effectively transmit the modern scientific-technological system (Raina & Habib, 2004). Raina identifies the similar events in the realm of general education with the case of Mathematics education. The transmission of modern science involved the translation of concepts and theories across trans-cultural boundaries. Raina points out that the process of translation of text books in the realm of mathematics education in nineteenth century colonial India involved the identification of already existing Sanskrit or the Persian and Arabic terms that were then used to express equivalent western terms (Raina, 2015). The introduction of modern science and technology while functioning on the pedagogic plane was deeply interacting with the cultural ethos of the colonized.

By 1850 cotton cultivation had witnessed many improvements (Bourbon cotton was introduced in the eighteenth century), which created the need for experimental farms and training facilities. An experimental farm was founded at Saidapet and an arrangement was made for training a few apprentices (Sen, 1991). After the Saidapet Farm, the Cawnpore Farm was the oldest Experimental Farm and it was visited more frequently by J.A. Voelcker during the period of his inquiry. The Cawnpore Farm was generally referred to as the "Model Farm", but Voelcker objected to this and argued that the name was inappropriate because it was neither a model nor a farm in the strict sense. Rather it was an Experimental Station in the true sense to which a certain area was added for growing certain selected seeds. Voelcker writes:

> I consider that the Cawnpore Farm fulfils well the purpose of its establishment. It is a well conducted Experimental Station, in a convenient position, and with a suitable soil; and, though faults in detail may be found with it, the general conception and working of it are thoroughly good. The Cawnpore Farm is, I think, more like what an Indian Experimental Station should be than any other I met with in the country, although its younger rival, Nagpur, bids fair in some respects to threaten its leading position (Voelcker, 1893).

The Cawnpore Farm was spread over an area of 42 acres with a fruit and vegetable garden extending over 65 acres of which a small area of 12 acres was used as a seed distribution farm for the sale of pure seeds. Attached to the Farm was a workshop where plough, pump and other implements were made and sold. The workshop contained local and Europeans implements. The prime objective of the Farm was to examine the methods of cultivation, the impact of physical factors on crop yield, and the introduction of new varieties of various crops, new implements and manures (Voelcker, 1893).

The farm undertook a series of manural experiments for testing the efficacy of manures such as cow dung, cow dung ashes, sheep dung, pondrette (night soil), saltpetre, gypsum, bone dust and bone superphosphate. Artificial manure was not used at all and Voelcker felt that there was little possibility of it being adopted (Voelcker, 1893). Experiments on wheat cultivation were carried out by applying manure not ordinarily used by common cultivators such as brick kiln refuse, silt, compost, road scrapings, ashes of weeds and ammonium chloride to ascertain their effect on crop yield (Voelcker, 1893, p. 361). Ammonium chloride was found to be the best manure among all other manures which were tested, but it was too expensive to be afforded by the native cultivator. Moreover, at the farm the best results in wheat growing and potato culture had been obtained with the use of wool waste which was obtained from the local woolen mills (Voelcker, 1893). Each day a bullock cart carried the waste from mills to the farm. These flows between agriculture and industry were enabled by the proximity of the agricultural farm to the city. Muriate (chloride) of ammonia obtained from refuse water from indigo manufacture called seet water was procured from the indigo cultivators for agricultural experiments. Though some good results came out from these experiments, these manures were beyond the reach of the local raiyat. Voelcker strongly condemned these experiments and suggested that the manures on which experiments have to be undertaken should be within the reach of the raiyats and were widely used throughout the country, or that were likely to be used in the future, taking into consideration local conditions and constraints, i.e. financial and cultural. Furthermore, he was critical of experiments employing manures that were too expensive or imported from England. On the other hand he stressed the need for improving the methods of cultivation that would not impose any financial burden on the cultivator (Voelcker, 1893). Describing the nature of experiment that could be useful for the cultivator, Voelcker stated that experiments should be as simple as possible; they should be self-evident, and ought only to need the minimum of explanation.

Besides this, an important factor for scientific inquiry was the manner in which the experiments were carried out. Voelcker pointed out that the methods adopted by the farms were on a wrong footing and remarked:

> it is difficult to determine exactly the effect of specific manure on a crop, if it was repeated on the piece of same land again and again, therefore it is not important to get large number of results as to make sure that those given are correct, rather they can only be verified by repeating them, not only on the same spot but on fresh land and in succession of years (Voelcker, 1893).

Moreover, he was skeptical of manurial experiments for Indian farmers as it was dependent on the availability of manure, instead he suggested undertaking experiments on the methods of cultivation. A more important task was to

popularize the improved varieties of various crops. Voelcker found that seed merchants were not common in India as they were in Europe. Moreover, there was no possibility of developing this market in the near future. Therefore, he suggested that seed farms should be established in each district by the provincial agriculture departments to distribute pure seeds to cultivators on low prices. Thus the prime function of the seed farms was the selection of high yielding seed varieties, and the introduction of new crop varieties. Voelcker suggested that rather than introducing too many exotic and imported varieties; emphasis should be laid on the introduction of native varieties grown in different parts of India, as evident from the successful cultivation of Muzaffarnagar wheat at Kanpur farms (Voelcker, 1893, p. 240).

Company officials and the colonial government denounced Indian implements for being simple, clumsy and rude as there were manufactured, changed and repaired without any skilled mechanic. The experimental farm was instrumental in introducing new implements and techniques. Different kinds of threshing machines, sugar-mills, sugar-evaporating machines, ploughs and pumps were also sold from the farm. Experimental farms in different parts of India had developed their pet ploughs for instance the Kaisar, the Duplex and the Watts plough at Kanpur, and the Messy plough at the Saidapet farm, Stormant plough at Khandesh and Seebpore plough at Calcutta (Sangwan, 2007). Most of these machines and implements were too expensive for the common cultivator, who was not trained in the overall functioning and repair of these machines (Voelcker, 1893). Nevertheless, the Kanpur farm had sold 84 ploughs (watts and kaisar), 22 pumps, 24 corn grinders (costing Rs. 25 each) and eight chaff cutters in the year 1888–1889. The pump commonly known as "Cawnpore Pump" was a kind of chain pump suited for raising water from the depth of 15 to 20 feet. The price of the pump varied between Rs. 40 to 50, depending on the depth at which it could operate (Voelcker, 1893). The pump was an adaptation of an Australian pump brought by Edward Buck, which was adapted for native farmers after several trials and modifications by W.J. Wilson of the irrigation department of the province. Though the pump worked fairly well at the depth of 15 to 20 feet but at levels less than 15 and more than 20 feet the native appliances were superior (Voelcker, 1893). The Farm had also become the training ground for a number of apprentices who would subsequently work on other farms. The Assistant Director mentioned in a Report that

> the Farm has a real, though possibly slow and limited, influence on the native agriculture. People often come to see it, and the services of farm apprentices and labourers are often borrowed. Thus, one was sent from here to the Central Provinces, to teach the making of the unrefined sugars termed gur and rab. Apprentices also come from other places to learn on the Farm (Voelcker, 1893, p. 362).

Moreover, the farm was undertaking experiments in cotton cultivation for local cotton-textile industry which largely catered to the demands of British Indian Army. Nankeen cotton commonly known as coloured cotton was imported from China; however, the cultivation of this cotton was promoted in India when Commander-in-Chief of the British Indian Army in July 1879 directed that the summer uniform of All Native Infantry Regiments should be khaki in colour. The seeds of this cotton were distributed in Madras, Bengal, Punjab and Bombay. Kanpur experimental farm also cultivated this cotton and supplied it to the local cotton textile industry. However, the cotton produced from this plant was not consistent in quality and there was no demand from civilians, which led to the discontinuation of its cultivation in 1887 (Mishra, 2008; Pande, 2007).

6 Onset of agricultural education in late nineteenth century colonial India

Historically, organized efforts to improve agriculture in England were initiated in the late decades of the eighteenth century by voluntary associations like the Lancashire Agricultural Society (1767), Royal Bath and West of England Society (1777), Oldham Agricultural Society (1783) and many more. Societies were organized by landowners and farmers in many counties and these societies published their own journals and supported the promotion of agricultural education (de Carrie, 2012). Voelcker was of the opinion that the socio-economic condition of Indian farmers rather than their intellect prevented them from adopting improved methods of cultivation. The Indian farmer was immersed in social customs and poverty that obstructed him from innovating or adopting new practices. Moreover, the smallness of land holdings, paucity of capital and financial obligations were other major factors responsible for their indifference towards innovation (Voelcker, 1893).

By the end of the nineteenth century chemistry was not merely instrumental in industrial development, but a new science of water, air and soil had generated new branches of chemistry i.e. agricultural chemistry, soil science, plant physiology and the like. Germany led the world in the application of science in agriculture while Britain lagged behind. The state generously financed a number of institutions in Germany by strengthening their physical infrastructure and human resources. Organic chemistry became the harbinger of scientific agriculture and the institutionalization of organic chemistry in the universities developed practical applications of science in agriculture. The founding of a laboratory at Giessen University by Justus von Liebig for

training students, paved the way for Agricultural Research Laboratories and Experimental Stations in the German speaking regions. It also popularized the application of agricultural chemistry for improving crop yield (Brock, 1997; Kumar, 2007). In all these endeavours farmers played a key role by drafting the charter for the establishment of the first publicly supported Agricultural Station at Mockern, Saxony in 1852. Further, the Government provided finances and statuary status for the same (Randhawa, 1983). The model was replicated across the continents in countries as distant as Japan, United States of America and other European nations.

Reflecting on the significance of agricultural education in India, Voelcker was deeply concerned with the pathetic condition of Indian education. He pointed out that in a country, where according to the figures of the Famine Commission 90% of the rural population more or less earn their livelihood by the tillage of the soil, their existing education system was diverting tillage away from the land (Voelcker, 1893, p. 379). The desire of landowners and proprietors to use agricultural land as the source of income without taking care of the soil and applying methods of scientific agriculture, had adversely affected agricultural land. While examining the attitude of cultivators towards agriculture he pointed out:

> Agriculture is not regarded as a profession, but too often as a medium for deriving an income off the land; owners of land do not look after their property themselves, but leave it to the care of superintendents, and prefer to make money in the town by trading rather than by agriculture (Voelcker, 1893).
> He further stated that, ... estate worth a lakh of rupees are managed by men on a pay of Rs 25 a month, there is no intelligent farming class, nor even a good class of superintendents; the young man after receiving his education, seldom goes back to the farm but soon sees the fact that the best chance for utilizing his education is at the Bar, or else in the Government employ; the student at an Agriculture College will rather take a government appointment worth Rs. 50 a month rather than devote himself to the management of his farm or superintend that of someone else; and, lastly, there is a general impression that everything pays better and is more dignified than farming (Voelcker, 1893).

Agricultural education in colonial India was not shaped by the sheer demand of cultivators for instruction in agricultural science, but for training the superintendents and managers for experimental farms (Chandranna, 2003). Considering this a course for a second class apprentice was inaugurated in December 1872 at Saidapet (the first Agricultural School) and was intended to provide agency facility for proposed working of the district farms. A stipend of Rs. 40 per month was allocated to six apprentices who were appointed. The eligibility for this apprenticeship course was that the candidate should belong to farmers or landowning communities and should be between 18 and 20 years of age (Ratnam & Sivaraman, 1966, p. 393).

In 1878, the Agricultural School at Saidapet was raised to the status of a college where the students enrolled for a three year diploma course. The course included instruction in botany, chemistry, veterinary science, physiology, book-keeping, mechanics, hydrostatics, geology and hydro practice. An experimental farm, a small botanical garden and a veterinary hospital were associated with the college to ensure sound practical training. The successful students were readily absorbed in remunerative jobs rather than sent back to the farms for practicing agriculture (Ratnam & Sivaraman, 1966). Voelcker was deeply concerned with this form of agricultural instruction at Saidapet and was opposed to this form of agricultural instruction (Voelcker, 1893).

The other model for agricultural education in colonial India evolved at Poona Science College where agriculture was one of the subjects in the Bachelor of Science course. The course commenced in 1877 and the college was affiliated to Bombay University under the guidance of the Principal, Theodore Cooke. The devastating famine of 1877 forced the provincial government to take firm steps for the improvement of agriculture through scientific methods. In the subsequent year an agricultural farm of 7.2 acres was attached to the college for imparting practical training to the students. The course was of 3 years duration and by 1890 Bombay University awarded a separate diploma in agriculture. Mathematics was a compulsory subject for 3 years, the second year courses included agriculture, chemistry, botany and in the third year geology and agricultural chemistry were introduced. A gradual progression of disciplines from the pure sciences to applied sciences was quite evident. A veterinary hospital and a bacteriological laboratory were an integral part of the college. Voelcker appreciated this form of higher agricultural instruction and advocated it by asserting that the college was dedicated to disciplines like chemistry, botany, physics etc. and was under the academic control of Bombay University while most of the faculties in other agricultural colleges were employers of the Agriculture department and had to perform multifarious functions apart from teaching (Voelcker, 1893, p. 450).

Ironically, it was difficult for the students who came out of Poona College to find employment in the government departments, since the college was affiliated to the university and not under the control of the Agriculture department. Voelcker was critical of the agricultural content in the courses specifically taught at Poona College for he felt that the content was tilted towards agriculture practices in England rather than in India. Moreover, practices imparted at Saidapet farm such as paring, burning, warping of land and manures such as sulphate of ammonia, dried blood-soot

and artificial manures grossly neglected the needs of Indian cultivators. On the other hand many subjects which had special reference to Indian agricultural practice were omitted such as canal and well irrigation, the use of oil cake refuse, dairying etc. (Voelcker, 1893).

By the end of the nineteenth century agricultural education was undergoing institutionalization at at various stages of education viz. primary, secondary and higher in Europe and United States of America. This opened opportunities for varied professions like farm managers, farmers, teachers for imparting agriculture instruction at schools, government officials in agriculture departments, experts and agricultural chemists; all requiring a sound knowledge of agriculture and its allied branches such as dairy and veterinary sciences. A network of institutions was founded for instruction in agricultural education; identical to what was happening in the realm of general education in the western countries. However, this development was very slow and limited to certain levels in colonial India. The opportunities was limited to the students trained in agricultural sciences except for the recruitment in agricultural department. Department of Revenue and Agricultural was overwhelmed with revenue administration and promoting cash crops rather than research and development for scientifically managing the agriculture. Moreover the landlord class was indifferent to invest in training farmers or assisting them with scientific knowledge. Contrary to colonial efforts for agricultural education Gaikwad III of Baroda adopted a multipronged approach; on the one hand school education was strengthened, on the other experimental farm, agricultural college and publication became the core for modernizing agriculture (Inamdar & Garg, 2019).

In India, a large section of the population was engaged in agricultural or allied activities, yet there was no provision for instruction in agriculture at elementary schools. Voelcker closely examined the existing condition of agricultural in India and figured out four professions for whom agricultural education was a pre-requisite. Firstly, the training of teachers for instruction in primary or secondary schools; secondly training of landed proprietors for the scientific management of their farms; thirdly to carry out an enquiry in agricultural science for future agricultural experts, and fourth for the officers of the land revenue department for whom agricultural training was a desideratum (Voelcker, 1893, p. 380). This required the development of a sound system of higher agricultural education, but this did not mean that he had not paid due attention to instruction at the elementary level. Conversely, he proposed that the development of agricultural education should take place in a holistic manner, where elementary education would feed higher education and train farmers for scientific agriculture and in return higher education would provide trained teachers for the former. He suggested that the programme of agricultural education should be moddled on Nagpur Agricultural Class in the Central Provinces which was dependent on the Poona College of Science for its teachers. The Principal and his two assistants in Nagpur College were former students of Poona Science College (Voelcker, 1893, p. 385). Hence, Voelcker suggested that the programme of higher and elementary instruction in agriculture should evolve simultaneously and that no system will be satisfactory which does not satisfy the requirements of both levels.

The more pertinent question concerned the nature of agricultural education, pedagogical process, curriculum and instituions where it should be imparted? By the time Voelcker had completed his inquiry, there were two models for agricultural education. The first model was that of the Saidapet Agricultural College in Madras Presidency, where agriculture was taught with allied disciplines. The second was that of the Poona Science College where agriculture was taught with other pure science disciplines. Voelcker was critical of imparting special instruction in purely agricultural subjects at a separate agricultural college or institution, but advocated the utilization of existing science colleges for this purpose, where training in science was already imparted as at Poona Science College and the results at large were impressive (Voelcker, 1893, p. 383).

Moreover, Voelcker had apprehensions about the potential for adequate instruction in the various branches of agriculture and whether there would be sufficient employment for teachers of ability in the department of sciences of a college which was associated with agriculture (Voelcker, 1893, pp. 381–382). Voelcker believed that instruction in agricultural sciences for the sake of government employment had to be discouraged. But reflecting on the condition of education where literary subjects were preferred for government jobs, it would be better if officials of the department of Revenue, Agriculture and Land had knowledge of agriculture and could appreciate the agricultural requirements of the district better than those who had merely a literary training. The prime aim of agricultural education was to impart training for revenue officials (Voelcker, 1893, pp. 383–384).

He strongly recommended that a university degree should be granted for agriculture rather than a diploma in agriculture. The granting of a degree would provide a stimulus to the study of agriculture while a mere diploma would fail to do so. Moreover, a degree in agriculture did not entail the study of agriculture in isolation without its association with other branches of sciences, rather learning agriculture with other branches of sciences viz. chemistry, botany, zoology and physics. Thus agriculture was to be offered as one of the optional subjects in the Bachelor of Sciences programme and where agricultural chemistry was incorporated as a special subject.

In pedagogic terms emphasis was placed on practical training for which demonstration farms and cultivation on a

small piece of land would become an integral part of instruction in agricultural sciences. At the elementary level, he proposed that the rudiments of agriculture should be introduced in primary and middle schools in the vernacular and small illustration plots should be attached where some principal field crop could be grown on a small scale as part of practical instruction. In order to further agriculture at the primary school stage; "readers" and "object lessons" should be prepared and introduced to students that familiarized them with agricultural subjects. In the Middle Schools, he proposed the inclusion of elements of physical science, the use of Agricultural Primers, accompanied by Illustration Plots. Lastly at the High School level a sound instruction in Physical Sciences and Agriculture, supported by practical instruction in farms or fields attached to the Schools was suggested (Voelcker, 1893, p. 385).

7 Agriculture school Cawnpore: disjunction between vision and reality of colonial government

Kanpur had emerged as the entrepot for the collection of Bundelkhund cotton by the early decades of the nineteenth century in the North India (Bayly, 1983). Allahabad, Mirzapur, Kanpur and Farrukhabad became prominent centres for trade and commerce in cash crops and grains, either catering to the emerging metropolitan economy of East India Company (EIC) trade or EIC Army. With the intensification of trade and commerce in Kanpur, the Europeans who flocked to the city to provide a range of services to the military camp also engaged in cultivating cash crops like indigo, opium and cotton from the late eighteenth century. The fertile soil of the region provided substantive yield, demanded the training of cultivators for processing opium and indigo, which were introduced by European planters. The connection of the city to the lower Ganges canal[8] and the development of experimental farms marked the introduction of science and technology for agriculture. These developments on the one hand facilitated the production of cash crops, on the other expanded the revenue collection for the colonial rulers.

The efforts of the provincial government in the cultivation of cash crops like cotton, opium and indigo, required experimentation in agriculture improvement for promoting the cultivation of these crops that finally resulted in the establishment of an Experimental Farm in 1874 at Kanpur. Besides cash cropping Kanpur emerged as an important territory for effective revenue administration. Agricultural improvement was largely linked to revenue administration. Colonial government effectively organized the revenue administration not merely by enforcing new laws but also redefining the duties and responsibilities of incumbents. The structure of pre-colonial revenue administration was retained, but its form and nature was transformed. The *patwari*, the *qanungo*, *mirdhas,* and *taluqdars* were retained but their power, responsibility and authority was altered. The *patwari* was a village official associated with the village community and dependent for his wages on villagers in cash or kind. This incumbent was transformed into a bureaucratic official for maintaining public records. Subsequently, by the Revenue Act of 1873 a cess was imposed for the payment of the *patwari* and thus a reorganization of this office was undertaken. Schools for the training of *patwaris* were established and rules for their guidance and supervision were laid down (Moreland, 1911, p. 75). The Director of Land Record and Agriculture ensured the instruction of surveying and mensuration on practical lines. especially for training the *patwari* and the *patwaris*' son, but instruction was open to all, in schools functioning in every district under the Education Department.[9]

The *qanungo* was a responsible and prestigious office under the Mughals, but lost its prestige during the Nawab's reign. The incumbent of this office inherited his position.

[8] The history of canal irrigation in the district dates back to the construction of the Ganges canal in 1842. The twin objective of irrigation and navigation, led to the construction of the Ganges canal originating in Haridwar and going up to Nanau in Aligarh district, where it bifurcated to form the Kanpur and Etawah canals, the former discharging into the Ganges in the city and the latter emptying into the Yamuna either in this district or in Fatehpur. The task for constructing the Kanpur branch, a stretch of 65 miles was undertaken by C.W. Hatchinson in 1849–1850. The canal was opened in 1854, but very little water reached the lower section till 1861, the first year in which the undertaking showed profit. The imbalance between the demand and supply of water led to modification of the project and in 1869 it was contemplated that a reservoir would be build at Narora in Bulandshahr district, the canal traversing the country between Pandu and Rind rivers at Kanpur, together with a supply channel for the Kanpur and Etawah branches as well as the Bhognipur branch for the benefit of the dry tracts of land along the Yamuna. The work was contemplated in 1872, but was modified time and again as the work progressed, but the Kanpur and Etawah branches were an integral part of the Lower Ganges canal system. The Kanpur branch of the lower Ganges Canal first touched the northern borders of the Bilahaur Tahsil at mile 95, and then flowed in the south-easterly direction through Bilhaur, Sheorajpur and Kanpur tahsil, tailing into the Ganges at Kanpur cantonment after traversing 43 miles in the district. The canal and its distributaries commanded almost the whole of the Bilhaur, Sheorajpur, portions of Kanpur and Narwal. The average area irrigated from 1902–07 was 29,179 acres of Kharif and 60,380 acres in the Rabi. See Nevil (1909). *Cawnpore: A Gazetteer Vol. XIX*, Allahabad, Superintendent Press, p. 51.

[9] From A. Calvin dated 8 September 1890 Home Education A Proceedings December 1892 No. 50, Papers related to Technical Education in India (1886–1904) in Bhargava K.D. 1968. *Selections from Educational Records of the Government of India Vol. IV*, Delhi, GOI, p. 92.

The British administration retained this office and transformed it into a position of a public officer at a monthly salary of Rs. 30 through the order of the Board of Commissioners in 1808. The duty of the *qanungo* was to assess the value of crop and measure the land. The *qanungo* possessed valuable information which was utilized by the British administration for introducing the permanent settlement. Nevertheless, by 1870 the Government found that a large number of *qanungos* were incompetent and thus they too were to be trained. The Land Revenue Act of 1901 lay down that the *qanungo* should be appointed 'for the proper supervision, maintenance and construction of annual registers and for such other duties as the Board may from time to time prescribe' (Gupta, 2006, p. 34).

The excessive revenue and agricultural needs of the provincial government resulted in a demand for establishing a school for training the local populations in revenue administration and agricultural practices. Consequently a committee was appointed in 1888 to inquire into the conditions of industrial schools in the North Western Provinces (United Provinces). The Committee recommended the establishment of an Agricultural School at Kanpur (Bhargava, 1968, p. 146). The primary function of the school was to train land revenue officials (circle inspectors) whose prime duties were to report on agricultural production, on agricultural disasters and collecting all statistical data pertaining to agriculture. The course was for 2 years duration and practical instruction was also imparted at the Government Farm (Bhargava, 1968, p. 172). Consequently, the Imperial Government accepted to open an Agricultural School for the training of revenue officials. A school was opened in 1893, chiefly to train the qanungos (revenue officials). But this was not an Agricultural School, but a revenue school and the experiments carried out at the Experimental Farm were precisely commercial in nature, with no concern for local agriculture and the cultivator.

Meanwhile at the fourth Agricultural Conference organized at Simla in 1890 delegates from all provinces assembled to deliberate on rejuvenating Indian agriculture. Voelcker also attended the conference and his preliminary note on Indian agriculture was also discussed. The conference for the very first time stressed the need for a sound system of scientific investigation as well as education in agriculture. The conference recommended that an expert was required for scientific investigation, apart from agricultural education. It was suggested that a first class agricultural chemist be appointed for the conduct of general investigation and an assistant for purpose of instruction (RCA, 1928). There was possibly a shift in colonial policy for the programme of agricultural development which was formerly oriented towards statistics and revenue assessment, had moved to practical agriculture. The other issue debated at the conference was whether agricultural education required a top-down or bottom-up approach? E.C. Buck favoured the latter and opined that agricultural education should not be directed towards awarding college degrees but imparting elementary instruction. Deepak Kumar has argued that the views of Buck were an outcome of the financial constraints of the colonial government, for Buck was otherwise in strong favour of high class agricultural colleges and the education of natives at Saidapet and Dehra instead of at Cirencester (Kumar, 1995). In other words it was felt that higher agricultural education should not be offered by specialist institutions, but should be grafted on the existing institution of higher education and preference would be given to men trained in scientific agriculture in revenue and cognate departments (Kumar, 1995, p. 129).

The recommendations of the 1890 conference resulted in the appointment of J.W. Leather and S.H. Collins as agricultural chemists (for the conduct of general investigation) and assistants (for the purpose of instruction) respectively. This marked the beginning of recruitment of scientific personnel in the Imperial Department. The agricultural experts engaged in research and the assistants took care of teaching at Poona, Dehra Dun and Saidapet on matters relating to forest and agriculture. These measures were inadequate as the Government neither provided any physical infrastructure nor the finances to carry out research (RCA, 1928). Moreover, these steps were a drop in the ocean for a vast country.

The excessive revenue and agricultural needs of the United Provinces' government resulted in a demand for establishing a school for training the local populations in revenue administration and agricultural practices. Consequently, a committee was appointed in 1888 to inquire into the conditions of industrial schools in the North Western Provinces (United Provinces). The Committee recommended the establishment of an Agricultural School at Kanpur (Bhargava, 1968). The primary function of the school was to train land revenue officials (circle inspectors) whose prime duties were to report on agricultural production, on agricultural disasters and collecting all statistical data pertaining to agriculture. The course was for 2 years duration with practical instruction imparted at the Government Farm (Bhargava, 1968). Consequently, the Imperial Government accepted to open an Agricultural School for the training of revenue officials. A school was opened in 1893, chiefly to train the *qanungos* (revenue officials). But this was not an Agricultural School, but a revenue school and the experiments carried out at the Experimental Farm were precisely commercial in nature, with no concern for local agriculture and the cultivator.

Nevertheless, at the Agricultural Conference in 1895 the Government reiterated its policy that the time had not yet arrived where agricultural instruction had to be imparted separately from general education and therefore instead of being a specialized area of study, agriculture became part of

general education as an optional subject (Jolepalyam, 1990). But only 2 years after this conference, in 1897 the Government revised its policy and proposed that Agricultural Colleges should be established at Madras, Calcutta, and Bombay and in some city in Northern India. The colleges would be under the jurisdiction of the Imperial government rather than Provincial Government to meet the needs of British India (Kumar, 1995). By the end of the nineteenth century the colonial government had taken cognizance of agricultural education, but with no definite policy about what to teach and whom to teach. This resulted in the initiation of agricultural classes in Sibpur Engineering College, Bengal and agriculture classes were introduced at some zila schools. However, Calcutta University did not include agriculture in its university entrance exam. Moreover, skepticism shadowed these efforts; if agriculture would be introduced in the university curriculum, it would produce job seekers rather than practical agriculturists (Jolepalyam, 1990).

Taking into consideration the resolution of 1897, which suggested the establishment of four Agricultural Colleges in four regions of India, the United Provinces' Government in 1901 asked Allahabad University to introduce the Faculty of Agriculture in the University so that Cawnpore Agricultural School could be raised to the College level? The principal objective for the college was to train teachers, to instruct landowners and maintain a supply of revenue officials. Research was to be encouraged and the award of postgraduate studentships and even doctoral degrees was contemplated. Though the University senate readily accepted the proposal, no further steps were taken in this direction. By the end of the nineteenth century, India had two Agricultural Colleges and some Agricultural schools catering to the needs of government and aspiring to reverse the adversities of recurrent disasters in Indian agriculture.

8 Conclusion

Agriculture was ingrained in the rural life of colonial India; its knowledge was disciplined by colonial state for its economic and administrative interest. Institutionalization of agricultural education by the late nineteenth century was driven by the needs of effective revenue administration rather than diffusing the scientific agriculture among cultivators. Experimental farms remained distant from the *rayat* as this enterprise engaged in introducing exotic crops and artificial manures. Although varied models of agriculture education emerged in the west like Land Grant Model of United States of America and dedicated Agricultural Colleges in Germany; yet British metropolis remained the model to emulate for Colonial state in India. Moreover curriculum and pedagogic process were shaped by narrower interest of the state to train officials like supervisors and quanungo for Land, Revenue and Agriculture Department. This not merely impinged the academic organization of agricultural education but restrained its application for greater social good of the cultivators.

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