CHAPTER 13

Questions of economics and hygiene: recovering and using excrement in Italian cities and countryside in the late 19th century

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In the 19th century in Europe, two problems directly related to the use of human and animal excrement intersected. The first was the need to find more and more fertilisers for cultivated land. This problem was solved by searching for new fertilising substances, such as Pacific guano[1] or the seeds of oil plants.[2] Consequently, and in view of the need for abundant organic material to fertilise fields, agronomic literature began to consider the possibility of systematically and industrially using organic residues from the cities, and thus not only the traditional organic fertiliser from animal excrement. The second problem was precisely the disposal of organic remains, especially in large urban centres.[3] Municipal waste raises three main problems: the collection of the material, its storage, including the identification of storage areas, and lastly, its utilisation. Each of these three phases created numerous hygienic and public health complications. This had been a focus of attention for centuries. In fact, since the Middle Ages, different solutions were experimented with in order to solve the problem of disposing of urban excreta,[4] and the question has recently become highly topical as a result of the debate on sustainability and the recovery of organic agriculture.[5] As we demonstrate with this paper, the need for fertilisers and the recovery of urban and rural excreta are two intertwined and mutually influencing issues.

Starting from these premises, our article analyses the phenomenon in the Italian context of the second half of the 19th century and up to the First World War, following two lines of research. The first refers to the situation in cities where commercial companies were set up to contract out the cleaning of public toilets and household cesspools. In this way, organic material was obtained for sale. The second examines the agronomic literature that attached great importance to the modernisation of stables and farmhouses for the collection of urine and excrement.

The elimination of organic waste in cities

During the 19th century, the debate on these issues was deepened and innovative ways of eliminating organic waste were studied. First of all, the question arose as to whether the cleaning of cities should be a public or private task. Each city adopted its own system. In some cases it was left up to individual citizens to carry out the cleaning, in other cases it was the public authorities that dealt with the problem, including through the system of contractors that were granted a specific licence.

With the arrival of contractors, the collection and use of excreta became an activity designed to make a profit. For this reason, a “mercantilisation” of human and animal excrement developed. This process can be observed, for example in Milan, with the formation of a specific professional group, the so-called *navazzari*, who were usually peasants who took the material collected from the cleaning of house cesspits to the countryside. The name *navazzari* derives from the term used to identify the tanker barrel (*navazza*) loaded onto the tank wagons in which the sewage was transported out of the city.

In the cities, therefore, there was a plurality of professions engaged in the collection of human excreta, often with a precise distinction by function. This, by the way, was not

only the case in Italy. In Victorian London, for example, there were scavengers or street collectors (bones, rags, excrement), street sweepers, and sewer workers.[6] And in Liverpool, from 1846, the city cleaning service became municipal, paving the way for public waste management.

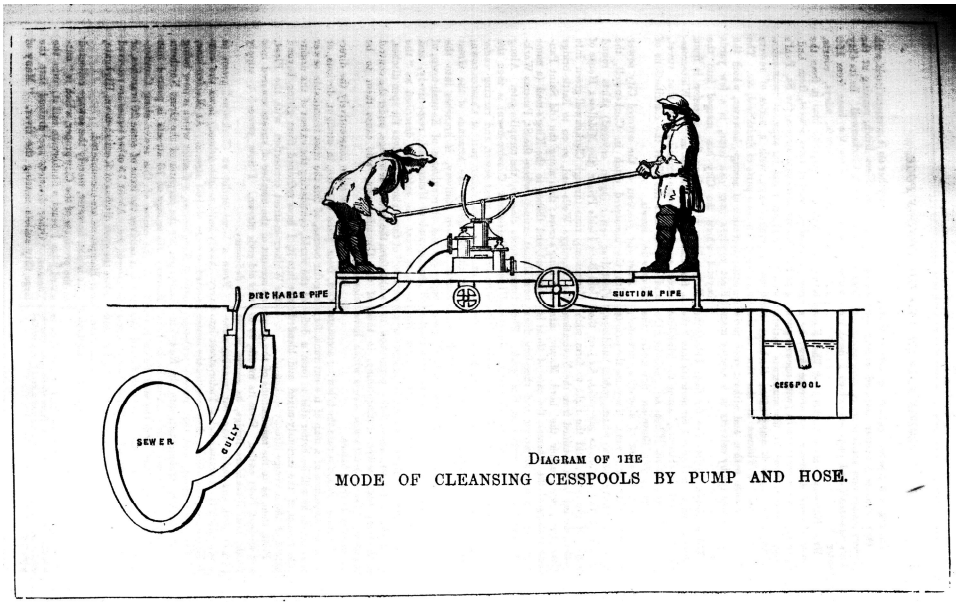


Fig. 1: "Diagram of the mode of cleansing cesspools by pump and hose", from Henry Mayhew's *London Labour and the London Poor*, 1851.

Clearly, during the 19th century the expansion of cities, with the consequent increase in hygienic problems and crowding in unhealthy environments, imposed the problems of collecting and managing city waste, which was on the rise, given that it was driven by the increase in industrial and commercial activities. The fear that the collection of piled-up waste, in addition to being a source of foul-smelling exhalations, might encourage the spread of diseases such as cholera or typhus, forced the authorities to start thinking about the measures to be taken to overcome the inadequacy of the facilities, but also about the lack of expertise on the part of the administrations in this specific area of city government.

Not surprisingly, one aspect of great importance was the ownership and management of landfills. In general, the population opposed the creation of suburban dumps, seeing them as a factor of degradation, a source of malodorous miasmas and an element of health risk.[7] The issue was not an easy one to deal with, because in addition to the identification of locations for the collection and disposal of human excrement, the city authorities had to deal with other equally important issues such as the location of a large number of other economic activities deemed to be harmful such as tanneries, ragpickers, and abattoirs.

One of the key issues was the transport of manure and slurry outside the urban enclosure. Often the solution came in the establishment of suburban dumps, collection points that acted as a link between the city that discards and the countryside that is hungry for organic fertiliser. Deposits of human and animal excrement to be used as organic fertiliser in agriculture became one of the elements that help define the environment of suburban spaces. Moreover, these collection centres promoted the construction of the image of these deposits as a factor of wealth and prosperity, i.e. places from which agriculture could draw organic fertiliser in abundance. From this point of view, the presence of the theme of collecting and using the organic remains of cities among the subjects studied in primary schools, where courses were taught that were useful for the growth of agriculture, appears emblematic.[8] It was, in short, a matter of inculcating among future farmers the idea that human excrement, as was the case with the Chinese, was of great

importance for the cultivation of plants. Therefore, cities were to encourage the construction of urinals and latrines suitable for the collection of these residues.[9] What becomes clearer from the last decades of the 19th century, however, is the consolidation of an entrepreneurial spirit in the area of the rational management of organic waste from cities. In fact, in order to promote the use of the organic material collected in the cities, companies emerged that were interested to conserve excrement by transforming it into a "resource". A decisive factor in the emergence of societies aimed at the collection, disposal and use of excrement and organic remains was the establishment of public slaughterhouses in cities. At the turn of the 20th century, a series of very important regulations was adopted in Italy regarding hygiene and the treatment of foodstuffs. Although the 1888 law on public health had not introduced any significant measures regarding the veterinary supervision of animals and meat, the subject of veterinary control became the subject of more systematic treatment in the law passed in 1902.[10]

Undoubtedly, the centralisation of animal slaughter brought with it the need to address the problem of the disposal of animal remains, including blood. For manure companies, slaughterhouses became a valuable source of organic remains. In Italy, the first municipal slaughterhouse was established in Turin in 1868, but the law of 3 February 1901 required all urban centres with more than 6,000 inhabitants to have a central slaughterhouse. Traditionally in cities, the slaughtering of animals was the task of private butchers. In Rome, it was only after 1825 that people began to talk about the need, especially for reasons of public hygiene,[11] to change from private to municipal slaughtering, which was much safer due to the presence of veterinarians and companies in charge of collecting the remains of slaughtered animals. In the then still capital of the Church state, the first plans to provide the city with a centralised slaughterhouse were realised under Leo XII following the design of the architect Gioacchino Ersoch.[12] With the demographic growth of Rome after the birth of the Kingdom of Italy, the number of animals slaughtered rose from 17,200 in the years 1825-30 to 60,000 in the 1880s, a growth that forced the construction of a new and large slaughterhouse in an area that was more suitable and easier to reach by railway lines.[13]

City	Cattle	Pigs	Sheep/goats	Horses	Total
Naples	43.320	35.041	151.156	--	229.717
Milan	113.835	41.991	18.723	6.700	181.249
Turin	46.232	11.127	92.628	288	150.275
Florence	41.315	4.010	80.000	--	125.525
Rome	49.539	44.305	19.851	795	114.510
Genoa	45.863	4.217	63.127	19	113.226

Table 1: Annual average of animals slaughtered in some Italian cities (1902-1906)

The phenomenon of the productive use of urban organic remains involved not only Italian cities[14] but also European cities, and it raised a wide range of problems. In a nutshell, there were two systems that could be adopted to dispose of faecal matter: collect the faecal matter in a tank (cesspit or mobile sewer), or feed the droppings directly into canals which, being rich in running water, carried them outside the city. These were systems that generated other issues that were not easy to solve. This is the case, for example, with the arrangement of latrines in the case of buildings for collective use. Each solution implied the adoption of specific solutions. In the case of fixed sewers, these had to be built of masonry and lime in such a way as to make the cesspools impermeable, thus preventing them from leaking. In these contexts, it was better to set up mobile cisterns that could be removed, emptied and then repositioned.[15]

The collection of organic remains stimulated technical solutions with the invention of new devices, including special metal cisterns. Even at the end of the 19th century in Italy, the system of connecting latrines to sewers or canals with running water was not widespread, since it was excessively costly, as it created the need for cities to have a

regular water service, in addition to the fact that it was difficult to manage water laden with faecal residues. The most suitable solution appeared to be mobile latrines, made of metal, hermetically sealed and easy to position and clean. The system of mobile latrines was practised in many European cities (Copenhagen, Stockholm, Edinburgh, Birmingham, etc.); even in Italy there was no lack of examples such as in Florence. In the asylum of Bassens, near Chambéry (France), the containers were placed in the basement, which was accessed via corridors from the outside, thus avoiding the risk of jeopardising the hygiene of the entire building. For this reason, mobile latrines seemed the most suitable solution.

Around the 1860s-1870s, commercial companies were set up in Italian cities to collect, process and market human excrement. These were mainly located in the cities of the centre-north (Alessandria, Bologna, Cremona, Mantua, Milan, Modena, Padua, Parma, Piacenza, Treviso, Udine, Verona and Vicenza).[16] In Milan, in the 1860s, there were approximately 5,303 houses, and 9,223 cesspools built under the soil of courtyards; the companies in charge of cleaning them numbered 26 and they owned over 200 metal barrels. The owners of the wells received an income from the cleaning companies in the concept of exclusive management of the collected material.[17] After various attempts in the 1950s to deal more effectively with the age-old issue of emptying cesspits,[18] in 1861 the Milanese municipality approved a new regulation for emptying domestic cisterns, according to which from 1864 the use of the old *navazze* or buckets with which organic residues were traditionally collected was banned; instead, homeowners had to use odourless systems approved by the municipal authority.

It was in this context that the *Società anonima per lo spurgo dei pozzi neri di Milano*[19] was founded with the aim of "extracting, collecting and transporting faecal matter" from the private and public cisterns of the city and the Corpi Santi of Milan, as well as any other city in Italy where such an industry was considered appropriate, and this both by means of the Chapusot barometric atmospheric system and by means of mobile ditches, pumps or any other odourless method approved by the laws in force. The company owned 51 barrels and claimed to own establishments for the conservation and practice of trading in faecal matter to facilitate the increase of agriculture. By the 1980s, this company owned five large tanks and thirty smaller ones with a total storage capacity of over 120,000 hectolitres.[20]

The above-mentioned *Società anonima per l'espurgo dei pozzi neri di Milano* exhibited its special *poudrette* at the National Exhibition in Turin in 1884. With this product, the company specifically tried to overcome two drawbacks of human excrement (combining faeces and urine), which is a very good fertiliser.

The drawbacks are, on the one hand, hygienic, i.e. the unpleasant and dangerous exhalations, and on the other economic, as the transport costs are very high because the droppings are in a liquid form. The *Società Anonima Milanese* produced a powdered fertiliser, prepared by adding marl to the droppings, which were then dried and ground. This also reduced the weight of the fertiliser, producing a great economic advantage.[21] It is clear, therefore, that decades of innovation in this area of production were involved, with the search for solutions that would favour the commercial spread of fertilisers.

As a rule, the storage facilities were located outside the built-up area, and appropriately equipped railway wagons were used to move the goods because of the need to avoid sewage spillage. In Florence in 1871, the *Società Anonima Fiorentina*'s factory, located three kilometres from the town centre,[22] began operation; the building occupied an area of 14,000 square metres and bordered on the railway line, so that 200 barrels of faecal matter of 10 hectolitres each could arrive every day. In the centre of the factory were the storage tanks, covered by a 10,000-square-metre forecourt that was used for handling and draining the fertilisers; around the forecourt was a covered loggia in which the fertiliser treatment machines were located.

The system functioned properly if the demand from agriculture allowed the holding tanks to be emptied regularly; otherwise, and in the absence of a contraction in demand, there was a risk of having immense open cisterns overflowing with nauseating organic substances. A situation that began to become a concrete reality at the end of the 19th century with the arrival of chemical fertilisers and oilseed cakes. In the Lombard city, in addition to the *Società anonima per lo spurgo dei pozzi neri*, other companies were active, such as the *Società mutua fra i proprietari delle case* which had 28 barrels, and the Junghi company, with 33 barrels.[23] The cesspit-purging companies were divided into two groups: those that purged and traded in the collected matter, and others that simply rented the barrels and tools to farmers who then took charge of carrying the faecal remains to the countryside. Previously, the house owners made a profit from the sale, while towards the end of the 19th century it was the owners who had to pay for the cleaning service. In Milan, there was also a company in charge of cleaning urinals.

A similar situation can be found in the case of the "cesspit cleaning company" founded in Perugia.[24] This company owned buildings in which the transformation of human excrement into fertiliser was carried out. Faecal remains appeared particularly suitable as fertilisers because they had a low water content, so if they were well preserved, they could last and be used for a long time. They also had a considerable amount of other nutrients: for example, nitrogen in higher proportions than Pacific guano. This fertiliser was perfect if it was mixed well into the soil with the addition of other organic fertilisers. In order to solve the problems arising from the cleaning of cesspools, the Company installed "sewers" or "mobile cesspools". The latter were metal containers that were installed in the city. The company took charge of collecting them, emptying them and putting them back on site after sanitisation. Another source of organic material for the cesspool companies was the cleaning of public urinals, which were equipped with these latest technical and hygienic innovations.

According to municipal regulations that came into force in Italian towns and cities from 1861 onwards,[25] in the case of the construction of new houses cesspools were not to be deeper than eight metres and had to have a capacity proportional to the number of people in the houses; they were to be built with bricks even at the bottom in order to avoid leaks. Particular attention was given to the openings of the wells, which had to be constructed so that there would be no leaks or fumes, while at the same time allowing the well to be emptied quickly and safely without spilling material. The wagons used to transport the barrels had to be clean, solid and equipped with a lantern for lighting at night. In order to move around the city, the wagons had to have a permit, following routes with little traffic. Once the wells had been emptied, the collected materials had to be taken with the utmost care to storage places located outside the city walls, no less than 300 metres from houses. It was forbidden to dump the organic remains into canals and watercourses.

In many cities, the danger of cholera attacks accelerated the process of introducing changes in the system of collecting and disposing of organic waste, changes that did not leave the population unwilling to introduce changes, even in the area of hygienic conditions of the houses. In Gorizia in the 1870s, there were 900 houses within the urban perimeter of which 700 had no cesspits.[26] In spite of protests from the population, in 1873 the municipality approved a new regulation on public health, which imposed the payment of a tax of 25 *lire* with which to meet the costs of setting up a night watch system and disinfecting the sewers. In the context of these changes, the municipality promoted the introduction of the pneumatic odourless system, an emptying procedure that ensured that all maladies were removed in a short time without the production of bad smells. While the procedure was much more in keeping with the conditions of civilised life, the inhabitants of Gorizia initially demonstrated their opposition to it because it was a paid system that awarded the service to a single contractor, preventing the well owners from continuing to profit from private contracting.

The system of mobile sewers was successful in Italy, and in fact an abundant bibliography is available for this type of equipment, as it constitutes a relevant aspect of

hydraulic and hygienic engineering, being particularly used in barracks, hospitals, schools and other centres where many people were present. For example, there is abundant publicity from companies specialising in the construction of mobile sewers, the best known being the firm S.C. Medail & C of Venice and Bologna, and the firm J.G. Bideu et C.

However, and this is a negative element to emphasise, there was a relative mistrust of the idea of urban excrement being used in fertilising fields: first and foremost, the fear that excrement from hospitals, mental hospital and prisons could contaminate plants, especially vegetables such as tomatoes and lettuces that were eaten raw, and could pass from them to the people who ate them.[27] In Italy, in the medical and hygiene treatises written during the 19th century, the question of the elimination of human excrement was a regular feature.[28] For example, the Neapolitan physician Francesco Roncati emphasises in his 1870 treatise the convenience of creating underground sewers. In his opinion, however, the use of sewers implies having large quantities of running water, a factor that makes it impossible to use faeces and urine as fertiliser. Within a few years, especially in cities, the companies for cleaning cesspits and selling excrement go out of business, because administrations choose to build the sewers underground. At the same time, organic fertiliser, especially of human or city origin (including the excrement of draught animals), is no longer needed so much, due to the increasing spread of chemical fertilisers.

The problem of having access to a constant and regular flow of water that could also be used in the sewage system[29] was particularly important in the cities of the south of the Italian peninsula where water reserves were very scarce.[30] In these cases, it was difficult to apply the Chandwich method (circulation not stagnation), a system adopted mainly in northern cities (Milan, Turin, Vicenza, Bergamo, Reggio-Emilia, ...) where the abundant availability of water resources made it possible to deal with the disposal problems generated by industrial development. This situation was very similar to that prevailing in Germany, where 279 towns and cities were cleaned between 1900 and 1907 by adopting essentially dynamic sewers based on circulating water. Therefore, in the southern cities and due to the lack of sufficient water resources, the only solution proposed was to use wells and impermeable pits, or at most, as in Catania, to use the force of gravity to drain the solid and liquid remains. In any case, the situation in the southern cities appeared extremely deficient, since simple wells or non-impermeable pits dug in the earth were used to collect organic waste, which did not prevent liquids from seeping in and polluting the water table and the soil. This was an extremely precarious hygienic situation that contributed to the greatly increased mortality rate in the event of epidemics such as the cholera epidemic of 1837.

In the history of works to improve the hygienic conditions of cities in Italy, a major role was played by the law of 14 July 1887, which granted municipalities subsidised loans for the construction of works that could improve the living conditions of citizens. It is not surprising to see that in Italy projects for the construction of sewers began to materialise precisely after this date. In Milan, the first studies for the construction of underground sewers date back to the years 1866-68, especially involving the central streets. The first municipal plan for the construction of a sewerage system dates back to 1888, a system that included a separation of white and black water, showing special attention to avoid stagnation and the depositing of solids. The final plan for a sewerage system in Milan came in 1890, designed by engineer Felice Poggi, and was based on the principle of receiving and disposing of domestic water, rain and black water at the same time, a criterion that would become the main model from the end of the 19th century onwards.

Another important Italian city where the need to modernise the collection of water, both white and black, began to be discussed towards the end of the 19th century was Turin.[31] The former capital of the Duchy of Savoy equipped itself with a network of main and secondary canals starting in 1726, which remained substantially in use until the 1780s, responding to the principle of bringing collected liquids out of the city to be deposited in infertile fields. As the 19th century drew to a close, a debate arose at municipal level on

which sewerage system should be used (single or double sewer). Opinions were divided, but among those who supported the solution of the single sewer prevailed the idea of using the excavation of the sewer channels to equally prepare the passage of telegraph and telephone wires and drinking water pipes.

In Naples too, towards the end of the 1870s, an intense political-technical debate began on the choices to be made regarding the disposal of organic substances.[32] There were various proposals in the field (cesspools, mobile sewers, pneumatic systems) but after an extensive exchange of opinions, the theory of continuous circulation prevailed, which envisaged the use of faecal water to promote the irrigation of large agricultural areas around the city of Campania.

Another case, very particular given the urban configuration of the city, was Venice. In fact, at the end of the 19th century the city on the lagoon was considered the one that "responded least to the needs of civilisation" in terms of sewage. Houses were divided into two broad categories: those that had a *cloaca* to be expurgated and those that discharged faeces and liquids directly into the canals.[33] Until the middle of the 19th century, all buildings were equipped with *gàtoli*, i.e. tunnels made of masonry that had the function of conveying all sewage directly to the various *rii*, i.e. the Venetian canals. These tunnels were conveyed into a collector, generally lined with bricks and with a rectangular cross-section, which collected the waste water from the Venetian sewers and rainwater. The level at which the *gatoli* were laid was such that the tides periodically cleaned and partly disinfected the conduits. It was widely believed that brackish water helped to purify urban waste, making it harmless to people's health. However, complex judgments about the urban solid waste disposal system were extremely negative as the sewers had to be opened to be cleaned, giving off an unbreathable odour. In a nutshell, Venice was a "public health hazard", shrouded in the gases produced by the putrefaction of the matter collected in the sewers and *cloacae*. Then there would be 519 urinals distributed throughout the city, of which 87 were washed out by a continuous dousing with water.[34]

Thus, in Italian cities, in the wake of the construction of underground sewage plants, there was no longer any reason for companies to clean cesspits and sell their excrement. On the other hand, organic fertiliser, especially of human or city origin (including trailing animal droppings), was no longer so necessary, because of the increasing spread of chemical fertilisers.

The rational recovery and preservation of organic barn remains

Even before the construction and spread of water-cleaned sewers in cities questioned the use of urban manure collection, a qualified debate on the rational use of stable manure began. One of the first books published in Italy on manure production and storage was by Filippo Re in 1815.[35] First of all, it was essential to calculate the quantity of stable manure available. In this sense, the most widely used figures indicated the proportion that we have summarised in Table 2 and which ideally corresponded to farms having three horses, eight oxen, ten dairy cows, six pigs and thirty sheep at their disposal for a total of 513 cubic metres of stable manure.[36]

Barn animals	Fertiliser kilograms	Cubic metres manure
Beef ox	25,352	43,7
Working ox	7,800	13,4
Horse	16,200	34,8
Dairy cow	19,500	34
Sheep	0,600	1,3
Pig	12,350	21,00

Table 2: Fertiliser produced annually by barn animals.

The 19th century, as we have said, was the century of organic fertilisers and for this reason in Italy there was an intense debate and abundant literature on the construction of building structures for the collection and storage of manure. One of the symbols of the modernisation of agriculture, in fact, is precisely the construction of rational manure stores (*concimaie razionali*). To summarise, a rational manure farm had to prevent the dispersion of the liquid from the accumulated manure, especially after rainfall, but at the same time facilitate, rather than prevent, the decomposition of the accumulated organic substances, and this was achieved by constructing on the ground, in a suitable place, an inclined, impermeable plane, which concentrated all the liquid drainages produced by the decomposition of the manure at one point. Fertilisers had to be proportional to the number and type of animals reared. As a rule, for every hundred kilograms of manure to be stored in good condition, 0.75 to 1 sq. m. surface area was needed. The buildings were to be square in shape in order to allow easy movement of the manure wagons.

Starting at the end of the 19th century and still during the 20th century, there was an intense debate about the need for farms to have good fertilisers,[37] thanks also to the translation of works published in other countries.[38] Despite progress in agriculture and animal husbandry in general towards the end of the century, in Italy stables were inefficient and the collection of manure and slurry was poor. Often there was no sump, or they were built and maintained in such a way that a large amount of liquid material was lost.[39] What treatise writers called *concimaie razionali* were still not widespread. Similarly, at the end of the 19th century, stables, which were built without any particular care to adequately collect the organic remains of animals, were very deficient. Therefore, along with the need for rational manures, agronomic literature turned its attention to the construction of stables according to criteria much more in keeping with modern agriculture.[40]

For Italy, a starting point was the first official enquiry made into the systems used in the countryside to collect and store fertilisers.[41] Official documents emphasised the need to learn how to build rational fertiliser stores, which were indispensable for learning how to store the available material well and to support the general progress of the post-unification agricultural sector. Ministerial sources also emphasised the fact that artificial fertilisers had not yet entered the habits of Italian farmers.

Ministerial investigations note that the basis of fertilisation is natural manure, especially from stable animals, but that its production falls too far short of needs. The spread and use of “rational manure stores”, where manure is stored and prepared according to the dictates of science, can improve but not completely solve the problem.

The use of human faeces and urine, plus waste from silkworm farms and spinning mills, together with the use of artificial fertilisers was seen as the way forward for the development of agriculture in the country. In this economy of reuse, the usefulness of making heaps containing the scrapings from the embankments, ditch drains, ashes, street and house sweepings, and cesspools was emphasised. These heaps, after being enriched with manure and urine, could be used effectively in order to fertilise.

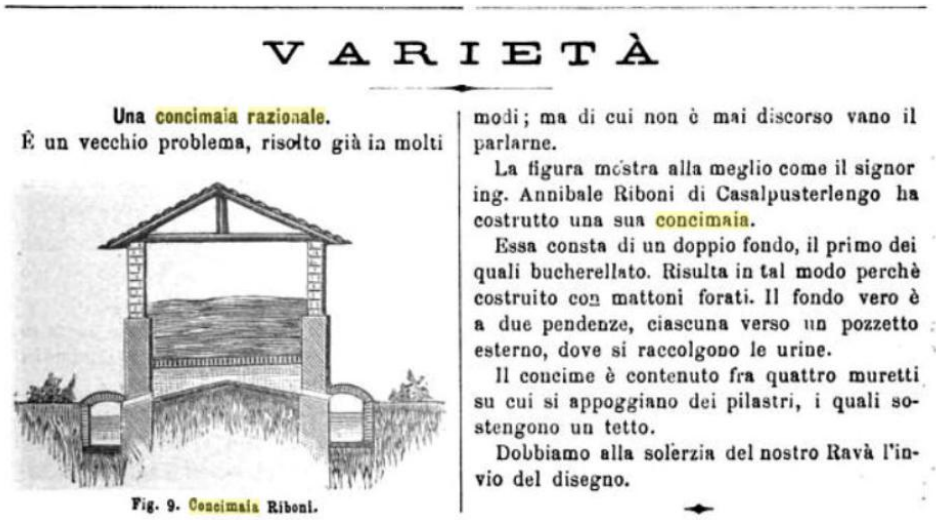
The same ministerial surveys, among other things, emphasised the fact that soil fertilisation should increasingly be valued as a fundamental factor for the productive development of agriculture and the safeguarding of the land itself.[42] For example, in Lombardy, especially in the Pavese and Lomellina areas, covered manure stores were widespread, as were tanks for collecting liquids from stables and pigsties. The practice of good and efficient fertilisation, among other things, was combined with the introduction of improved ploughs that allowed better cultivation of the land.[43]

The improvement of agricultural practices, including through efficient fertilisation, was a need felt even in the South of the peninsula. The concept of efficient fertilisation was to return to the soil the fertility taken away by repeated plant cultivation. Since large livestock farms were less common than in the North, experts recommended preparing

organic fertilisers from the residues of agricultural products, weeds, waste from many industries, the dung of farmyard animals, manure and rubbish.[44] What was essential, however, was that the fertiliser should be prepared, which is why "rational manure stores" had to be constructed. In fact, in order for fertilisers to manifest their efficacy (and not be harmful), they first had to undergo a special preparation, which was done in the manure stores.

As in the north of the country, "rational manure stores" began to spread in the south, as the competitions with prizes organised by the local agrarian associations/councils demonstrate. In 1889, in the Catania district, there was a competition that allows us to understand how "rational manure stores" were constructed in the south. They were partly different from those in the North because of the very different climate, especially in summer.

Three competitors took part in the competition, two of which were awarded bronze medals and 100 Italian lire. One of the two prizes was awarded to Giacomo Papale in Tenuta Leucatia in the municipality of Catania, for an underground fertiliser tank consisting of two cement tanks, with a factory roof and only one opening towards the north. The second prize went to Carlo Beek in Tenuta Lenzi in the commune of Belpasso, for an underground manure pit, but without a cover, which was in communication with the stable by means of a gutter that collected urine. In general, the two manure factories, according to the judges, represented the right type of manure factory in the hot climate.[45]



VARIETÀ

Una concimaia razionale.

È un vecchio problema, risolto già in molti modi; ma di cui non è mai discorso vano il parlarne.

La figura mostra alla meglio come il signor ing. Annibale Riboni di Casalpusterlengo ha costrutto una sua concimaia.

Essa consta di un doppio fondo, il primo dei quali bucherellato. Risulta in tal modo perchè costruito con mattoni forati. Il fondo vero è a due pendenze, ciascuna verso un pozzetto esterno, dove si raccolgono le urine.

Il concime è contenuto fra quattro muretti su cui si appoggiano dei pilastri, i quali sostengono un tetto.

Dobbiamo alla solerzia del nostro Ravà l'invio del disegno.

Fig. 9. Concimaia Riboni.

Fig. 2: Rational manure store (*concimaia razionale*)

From the last decades of the 19th century, there is an abundant bibliography on the construction of rational manure facilities, which became a symbol of modern agriculture. They represented a considerable progress in the structures of agricultural holdings, which in the same years also saw important engineering transformations in the stables and cellars for processing and storing wine. In this specific case, the rational manure structure had the following elements: a covered masonry structure, with underground concrete tanks, impermeable, communicating with the stables through a channel.

In order to encourage the construction of modern facilities for the proper storage of organic manure from the stables and from farmhouses, prizes and competitions were organised by Comizi Agrari and the Ministry. The condition for participating in these competitions was that the buildings technically met all the requirements for the proper handling and storage of manure. Manure consisted of that derived from the aforementioned livestock, sheep, pig and chicken droppings, which taken together were the solid and liquid droppings of the animals kept on the farms, including materials that serve

as bedding. The materials used for this were wheat straw, sometimes maize stalks and finally leaves from trees gathered in the countryside.

The Italian case demonstrates the intertwining of the dual logics of economics and hygiene in the management of farm animal and human excrement. Alongside the hygienic aspects, the debate develops on the rational use of these materials for agricultural purposes, as well as business opportunities for the collection, processing and trade of organic fertiliser. Especially for the fertiliser that originates from human excrement, however, the trajectory of development came into crisis with the development of modern city sewers and the manufacture of chemical fertilisers.

Again, in the 1930s, in the midst of the fascist era, propaganda continued on hygiene grounds about the need to have good systems for collecting household waste. It was seen as necessary to prevent the spread of flies and other insects. For this reason, fertiliser depots had to be closed; and depots established by the municipalities had to be built to centralise the collection.[46] According to the law of 1926, all rural stables with more than two adult animals were obliged to have a manure trough with an impermeable bottom built of masonry, cement or concrete, with a sump or liquid collector. Later, in 1929, it was stipulated that the tanks for the collection of stall remains had to be positioned at a distance of more than 25 metres from dwellings, so that the hygiene of the houses would be compatible with the need for farms to have an adequate and well-preserved store of manure.

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NOTES

1. Alexander James Duffield, *Peru in the Guano Age*, Legare Street Press, London 2022; David Hollett, *More Precious than Gold. The Story of the Peruvian Guano Trade*, Fairleigh Dickinson, Madison 2008; Gregory T. Cushman, *Guano and the Opening of the Pacific World: A Global Ecological History*, C.U.P., Cambridge 2013.

2. Manuel Vaquero Piñeiro, "Globalising livestock feeding: oilseeds and animal feedstuff (1800-1940)", *Global Environment*, 16 (2023), pp. 521-58.

3. See: Martin V. Melosi, *Garbage in the Cities: Refuse Reform and the Environment*, University of Pittsburgh, 2004.

4. Ercole Sori, *La città e i rifiuti. Ecologia urbana dal medioevo al primo Novecento*, Il Mulino, Bologna, 2001; Piero Bevilacqua, *La mucca è savia. Ragioni storiche della crisi alimentare europea*, Donzelli, Roma 2002.

5. Gregory A. Barton, The Global History of Organic Farming, Oxford (UK), Oxford 2018; Marcelo Larramendy and Sonia Sdoneski (eds.), *Organic Fertilizers – History and Applications*, IntechOpen, London 2019.

6. Mayhew Henry and Others, *The London Underworld in the Victorian Period: Authentic First-Person Accounts by Beggars, Thieves and Prostitutes*, Dover Publications, New York 2005 (first edition, 1862).

7. A reference to the case of Paris is useful here: ordinances were published in 1867 and 1872 that favoured the establishment of private garbage dumps. In the same years the Richer company was founded, which was the concessionaire of the Lesage dunghill; in 1880 the Compagnie Parisienne des Vidanges et Engrais (a private company with the aim of emptying cesspits) was established; in 1883 the Compagnie d'Assainissement et de Fertilisation.

8. *L'educatore italiano*, anno XIII, n. 17 (29 April 1869), p. 131.

9. It was estimated that a city of one hundred thousand inhabitants produced over 40 million kg of organic material annually, *Farmer's Journal. Popular Journal of Practical Agriculture*, VIII, 8 (1887), p. 5.

10. Leonardo Colucci, *Produzione, commercio e politica sanitaria degli animali in Italia*, Frascati, 1904, pp. 125-9.

11. Roberto Cea, *Il governo della salute nell'Italia liberale. Stato, igiene e politiche sanitarie*, FrancoAngeli, Milano, 2019.

12. A. Cremona, C. Crescentini, C. Parisi Presicce, *Gioacchino Ersoch architetto comunale. Progetti e disegni per Roma capitale d'Italia*, Palombi Editori, Roma, 2014.

13. G. Solinas, "Il nuovo mattatoio mercato del bestiame della città di Roma", in *Annali della Società degli ingegneri e degli architetti italiani*, parte I, tip. Fratelli Centenari, Roma, 1861.

14. Annali del Ministero di Agricoltura, Industria e Commercio. Parte prima. Agricoltura. *Notizie sull'uso delle acque di fogna nell'interesse dell'agricoltura*, anno 1876, vol. 81, tip. Eredi Botta, Roma, 1876.

15. Luigi Pagliani, "Le fosse mobili", *Giornale della R. Società italiana d'igiene*, III (1881), p. 170.

16. *Statistica ed elenco generale degli istituti di credito e della società nazionali ed estere esistenti nel Regno al 31 dicembre 1876*, tipografia eredi Botta, Roma1877, pp. 90-4.

17. Emilio Bignami, "La pulizia stradale delle città", *Il politecnico: rivista dell'ingegnere architetto civile ed industriale*, XXXIV (1886), pp. 239-47.

18. Paola Zocchi, *Il comune e la salute. Amministrazione municipale e igiene pubblica a Milano*, Milano, FrancoAngeli, 2006, pp. 154-60.

19. *Statuto della società anonima per lo spurgo inodore di pozzi neri riformata ed ampliata sulla già esistente società Donati e comp.*, Milano, tip. di Francesco Maniri, 1861. Per lo statuto della società di Cremona, *Statuto della società anonima cremonese per la raccolta e smercio delle materie fertilizzanti*, Cremona, tip. Ronzi e Signori, 1871.

20. Emilio Bignami, G. Tagliasacchi, "Studio sulle fognature di Milano", *Il politecnico: rivista dell'ingegnere architetto civile ed industriale*, anno XXXIV (1886), pp. 438-45.

21. "L'agricoltura alla Esposizione Nazionale in Torino 1884. Memoria del vice-presidente comm. avv. Luigi Arcozzi-Masino", in *Annali della R. Accademia d'Agricoltura di Torino*, Torino, Tip. e Lit. Camilla e Bertolero via Ospedale 18, 1884, p. 183.

22. Società anonima fiorentina, *Fabbricazione e vendita dei concimi artificiali. Programma agli agricoltori*, Firenze, tip. Carnesecchi et figli, 1873, pp. 6-7.

23.*Atti Primo congresso degli ingegneri ed architetti italiani*, Milano, tipografia Degli Ingegneri, 1875, pp. 167-76.

24. Archivio di stato di Perugia, *Società economico-agraria di Perugia, Società anonima per la pulizia dei pozzi neri*.

25. Carlo Borda, *Formulario del manuale dizionario di amministrazione municipale: provinciale e delle opere pie*, Torino, Sebastiano Franco e figli editori, 1861, pp. 547-8.

26. *Risposta dell'impresa della vuotatura dei pozzi neri al ricorso di alcuni cittadini contro il regolamento municipale di 1 marzo a.c, n.696* [s.d].

27. Francesco Selmi, "Feci umane considerate come ingrasso", in *Enciclopedia di chimica scientifica e industriale ossia dizionario generale di chimica*, vol. VI, Torino. Unione Tipografica Editrice, 1873, pp. 45-62.

28. Francesco Roncati, *Compendio d'igiene per uso dei medici*, Napoli, 1870, p. 449; Marino Turchi, *Sulla igiene pubblica della città di Napoli*, Napoli, 1862.

29. On the history of water supply in Italian cities at the end of the 19th century see Antonio Bonatesta, *Acqua, stato, nazione. Storia delle acque sotterranee in Italia*, Roma, Donzelli, 2023.

30. Raffaele Tramonte, "Fognatura nelle Puglie", *Giornale del genio civile. Rivista dei lavori pubblici*, anno LVII, 1919, pp. 217-36.

31. Giacinto Pacchiotti, *Sulla fognatura in Torino. Raccolta di articoli scritti in difesa del rapporto della prima commissione municipale*, Torino, Stamperia dell'Unione Tipografica-Editrice, 1888.

32. *Giornale della società italiana d'igiene*, Milano, Stabilimento Giuseppe Civelli, anno secondo (vol. II), 1880, pp. 560-2.

33. *La fognatura delle città*, in *L'Ateneo veneto rivista mensile di scienze, lettere ed arti*, Venezia 1894, p. 89.

34. *Ibidem*, p. 111.

35. Filippo Re, *Dei letami e le altre sostanze adoperate in Italia per migliorare i terreni e del come profitarne*, Milano, Giovanni Silvestri, 1815.

36. Antonio Selmi, *Dei concimi di stalla: loro produzione, loro conservazione e metodi per amministrarli ai campi. Lezioni di chimica agronomica*, Torino, Unione tipografico-editrice, 1863.

37. F. Marinoni, *Le concimaie razionali*, [s.n.t.]1888; Alderige Fantuzzi, *Conservazione dello stallatico e concimaie razionali*, Bellinzona, tip. Cantonale, 1903; Italo Giglioli, *Concimi, mangimi, sementi e sostanze antiparassitarie: commercio, frodi, e repressione delle frodi, specialmente in Italia*, Roma, Tipografia della Camera dei deputati, 1905; Pietro Cassella, *I concimi, loro applicazione alla fertilizzazione del suolo: completo manuale pratico ad uso dei proprietari e degli agricoltori*, Catania, tipografia Battiato, 1906; Siro Martini, *Le buone concimaie*, Casale Monferrato, F.lli Marescalchi, 1927.

38. Albert Stutzer, *La conservazione e l'impiego dello stallatico*, Milano, Francesco Vallardi, 1907.

39. Information of this kind is very present in the volumes of the *Inchiesta agraria Jacini*, Manuel Vaquero Piñeiro, Francesca Giommi, *L'Umbria nelle "memorie" inedite dell'Inchiesta agraria Jacini (1877-1884)*, Perugia, Istituto per la Storia Contemporanea dell'Umbria – Editoriale Umbra, 2017.

40. Francesco Bertolazzi, *Le stalle. Costruzione a nuovo, riattamento e sistemazione di fabbricati esistenti, concimaie, opere annesse, norme edilizia rurale*, Bologna, Licinio Cappelli, 1939.

41. *Dei concimi, Relazione intorno alle condizioni dell'agricoltura nel quinquennio 1870-1874*, vol. secondo, Roma, 1876, pp. 496-540

42. *Ibidem*, p. 111.

43. *Notizie e studi sulla Agricoltura (1877)*, Roma, Tipografia eredi botta, 1879, p. 22.

44. M. Jossa, "Concime e concimaia", *L'Agricoltore Calabro-Siculo. Giornale d' Agricoltura Pratica*, anno XV, 1890, n. 24, pp. 430-1.

45. *Ibidem*.

46. *Notiziario dell'amministrazione sanitaria*, anno I, 1938, pp. 431-7.

SOURCES

Fig. 1: Henry Mayhew

https://commons.wikimedia.org/wiki/File:Diagram_of_the_Mode_of_Cleansing_Cesspools_by_Pump_and_Hose.jpg

Fig. 2: Rational manure store

Giornale d'agricoltura del Regno d'Italia, XXV, 2 (1888), p. 47.

Table 1: Average of animals slaughtered

L. Zerboni, "L'allevamento dei bovini ed il consumo delle carni", in *L'Italia economica. Annuario delle attività nazionali*, anno II, 1908, pp. 98-100 (p. 99).

Table 2: Fertiliser produced annually

Antonio Selmi, *Dei concimi di stalla: loro produzione, loro conservazione e metodi per amministrarli ai campi. Lezioni di chimica agronomica*, Torino, Unione tipografico-editrice, 1863.