Cultivating Famine: Data, Experimentation, and Food Security, 1795-1848[1]

Abstract

Collecting seeds and specimens were integral aspects of botany and natural history in the eighteenth century. Historians have until recently paid less attention to the importance of collecting, trading, and compiling knowledge of cultivation, but knowing how to grow and maintain plants free from disease was crucial to the agricultural and botanical projects of the time. This is particularly true in the case of food security. At the close of the eighteenth century, European diets (particularly among the poor) began to shift from a dependence on wheat to a dependence on potatoes. In Britain and Ireland, the damages to crops caused by diseases like 'curl' and 'dry rot' during these decades were extensive— leading many agriculturists and journal editors to begin collecting data on the cultivation of the potato in particular, with the intention of answering practical questions about the causes of disease and potential methods that might mitigate or even eliminate their appearance. Citizens not only produced the bulk of this data, but also used agricultural print culture and participation in surveys to shape and direct the interpretation of this data. This article explores this forgotten scientific ambition to harness the knowledge and practices of citizens and farmers in order to bring stability and renewed vitality to the potato plant and its cultivation. In this article, I argue that while many agriculturists did recognise that reliance upon the potato brought with it unique threats to the food supplies of Britain and Ireland, their views on this threat were wholly determined by the belief that the diseases attacking potato plants in Europe had largely been *produced* or encouraged by erroneous cultivation methods.

Introduction

In 1846, during the outbreak of *Phytophthora infestans* (potato blight) in Ireland that caused the Great Famine, the former director of the Botanical Gardens of Dublin, Ninian Niven, decided to try and electrify a field of potatoes.[1] The idea wasn't his own, precisely—in 1845 there was widespread interest in the agricultural press in Robert Dewey Forster's methods for harnessing the electrical currents of the atmosphere to encourage plant growth, and Niven himself believed that, just like water or sunlight, electrical current was a factor in the growth of plants that could be controlled through adopting experimental methods [figure 1].[2] Niven was also deeply familiar with cultivation methods for the potato: he had spent a decade at the botanic gardens working to improve potato varieties on an area of land dedicated to such experiments.[3] The idea that the disease could be eliminated by altering cultivation practices was supported by decades of evidence accumulated in agricultural journals. Niven viewed the agricultural press as a key record to understanding the nature of potato blight and its potential causes. As he argued during the failures of 1846: 'we are not without resources, neither may it be unimportant to trace up the remarkable workings of some of the diseases that have followed in the cultivation of the potato up to the present time.'[4] In his treatise on the 'potato epidemic'

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Niven included accounts of cultivation practices and farmer's anecdotes from the failures of previous years; but he included no comment on 'the dissecting-knife and microscope of the acute physiologist, the crucible and the analyses of the investigating chemist,' for these 'have all, hitherto, been used in vain.'[5] In 1846, for the botanist Niven and for many others, diseases in cultivated plants were to be understood through their cultivation.

The appearance of *Phytophthora infestans* revolutionised the science of plant pathology-- Anne Libert in Belgium, Francis Camille Montagne in France, and Miles Berkeley in England all argued that fungi played a causal role in the outbreak of the disease, and arguments that diseases in the potato were caused by degeneration or poor cultivation gradually lost support.[6] The microscope and the dissecting-knife proved important to understanding blight; but this narrative obscures a vast and decentralised research project that had dominated the agricultural sciences for many decades: namely, the project to stabilise the varieties of potato cultivated in Britain and Ireland, in order to ensure a year-round supply to its growing populations. Cultivation methods are crucial to the plant and life sciences, and without adequate structures to collect and diffuse cultivation knowledge, the exploitation, study, and use of plants grounds to a halt.[7] But because cultivation knowledge is often in the hands of figures outside of scientific networks, its centrality only emerges when things go wrong. Recent historiography has drawn this fact out: using efforts to establish tea plantations in the United States as a case study, Courtney Fullilove has shown that, by assuming 'seeds were effective substitutes for agronomic knowledge', cultivators found themselves lacking the knowledge and labour approaches in order to successfully cultivate tea in America.[8] The collection, organisation, and diffusion of data was integral to horticulture and agriculture just as it was to natural history. As Staffan Müller-Wille has argued in the case of natural history, it was 'an information science, that is, a science whose primary aim consists in the storage, organization, and mobilization of knowledge.'[9] Horticulture, like natural history, was an information science, and cultivation methods had been respected as important knowledge by multiple actors within the plant trade, medicine, physiology, and agriculture.[10] Cultivation provided the means by which natural history practices were intertwined with state and civic projects, particularly during periods where war, disease, or poor weather threatened food security. The development of these knowledge communities and practices are understood to have played a crucial role in providing a means of producing knowledge of the natural world.[11] The pressure to understand and compile data on cultivation of the potato was driven by war, population growth, crop failures, and climate instability—while it only ever existed in print editions of journals like *The Gardener's Magazine,* editors and agriculturists worked in the early nineteenth century to collect all the variations in practice that existed in Britain and Ireland, in the hopes that relationships to crop failures, the appearance of disease, and higher yields would emerge.

In this article, I show that the appearance of diseases that attacked potato plants in Britain and Ireland led to a widespread drive to compile and gather data on cultivation. The diffusion of this data, I argue, reinforced and popularised a specific way of viewing diseases in cultivated plants. The ubiquity and widespread cultivation of the potato makes it an ideal case through which to examine popular understandings of the differences between disasters and ailments that are the product of nature, and those that are the product of human culture. In the century leading up to 1845, the potato had gone from being perceived as a foreign plant to a staple crop of Europe.[12] Emma Spary has even referred to the French First Republic as 'The Potato Republic', given the root's significance to the republican philosophy and cause.[13] Its journey was complex: the introduction of potatoes to an agricultural region is regularly understood to be caused by shortages in staple crops.[14] David Gentilcore has documented the cultivation of the potato in Italy, showing that repeated harvest failures—particularly in 1816—led to the increased cultivation of the potato. Around the same time, Austria decreed that all those renting public lands must use some of it to cultivate potatoes.[15] But as Rebecca Earle and

Spary have separately shown, the increased cultivation of the potato was by no means limited to situations where shortages and failures were endemic. The potato had popularity in itself--while it unquestionably became increasingly a means of sole subsistence for the poor in many countries, it also became a ubiquitous feature of European diets.[16] Malthus, deeply sceptical of potato cultivation at times, praised it in other contexts, noting in his discussion of recent improvements in Norway that: 'Almost everywhere the cultivation of potatoes has succeeded, and they are growing more and more into general use, though in the distant parts of the country they are not yet relished by the common people.'[17] In Britain, technological changes in harvesting, the enclosure of common lands, and rising unemployment at the close of the eighteenth century led to the introduction of potato grounds and allotments as a state response to poverty.[18] Almost everyone in Britain and Ireland had immediate interest in cultivation methods for the potato plant; and with that interest came a pressing need to comprehend whether the diseases and ailments that plagued the plants arose from nature or their own practices.

Drawing on archival records of the Agricultural Board and on gardening, horticultural, and agricultural magazines published in the early decades of the nineteenth century, this paper argues that the debates and investigations into plant diseases in the late eighteenth and early nineteenth centuries can help us to understand how agriculturists, scientists, and the wider public distinguished between natural disasters and those caused by culture, industry, and agriculture. While the actors considered here did not have concepts of 'ecology' or 'environment' at their disposal, the lasting damages that agricultural practices could inflict upon plants and countryside were not only widely understood, but also probed and investigated. This movement involved a sustained and crucial involvement of the public in Britain and Ireland: citizens not only produced knowledge, but had a hand in determining the shape of the scientific theories on disease that emerged in the agricultural press, and they were also, ultimately, the ones that would put agricultural science into practice.[19]

'Curl' and the drive for data

The urgency behind compiling the cultivation methods used to grow potatoes in Britain was driven by the proliferation of diseases that attacked the plant—of these, the most prominent and feared was the curl. 'The curl' or 'Curl'd Tops' as it was first known in Britain was most likely a complex of potato viruses identified today as Y and X.[20] Redcliffe Salaman traced the first reference to curl back to a treatise on agriculture published in 1751.[21] In his extensive studies of the impact of the disease, Salaman stresses that the disease was so damaging (up to 75% of a crop could be lost), that by 1775 some were questioning whether the cultivation of the potato should be abandoned in the north of England.[22] Failures in Britain and Ireland due to curl in 1780 motivated William Raley to write a treatise on curl, in which he set all the blame upon poor cultivation methods. To quote:

> Thus people, unskilled in the cultivation of the earth, and the vegetation of plants, &c. begun with many strange and erroneous methods of setting Potatoes of all kinds, whether sound or unsound, just as they came to hand, and thought no more about it, until they found their succeeding crops were not according to their expectation, and then they said that the Potatoes were in a state of natural degeneration, instead of truly saying the fault was in themselves.[23]

In 1784, Ilford Market Gardens abandoned the popular variety 'red-nosed kidney' due to failures.[24] In 1790, three papers were delivered at the meeting of the Society for the

Encouragement of Arts, Manufactures, and Commerce on the causes of curl. Two of the papers blamed degeneration, while a third – by William Hollins, blamed over-ripe seed. Hollins would later bring his own seed potatoes to meetings, with certificates, declaring them free of the disease.[25] Still others suspected that the curl was tied to the fact that the potato was naturally suited to cultivation at high altitudes. Writing on the curl, John Naismith observed in 1792 that 'it has been confined to low-lying lands, and has not yet reached any place in this part of the country, which lies more than 350 feet above the level of the sea.'[26] Others shared the idea that some regions were simply unsuited to cultivating the potato. There were failures in 1800 and 1801 in Britain and Ireland due to curl, leading to starvation in Ireland.[27] The impact of curl was frequent enough that agriculturists in Britain remained focused on its causes.

In 1793, pressed by the belief that the revolution in France had been caused by food shortages, the Prime Minister William Pitt agreed to the creation of a Board of Agriculture that would undertake statistical and scientific investigations into Britain's ability to feed itself.[28] The voluntary society had a wide variety of participants—its numbers included the chemist Humphry Davy, the horticulturist Thomas Andrew Knight, the agriculturists Arthur Young and William Marshall, and occasional visits from Joseph Banks, then-president of the Royal Society.[29] Subject to internal divisions, debate, and also some confusion over its status as a voluntary society, the Board of Agriculture nonetheless was the first institution in Britain to work to compile testimonies related to the incidence of curl and dry-rot in potato crops and also to compile and publish reports on cultivation methods. In 1794 and 1795, unusually poor weather led to crop failures throughout the country, and while potato crops suffered, the damage done to the wheat crop drew intense scrutiny towards the suitability of potatoes as a solution for maintaining stable food prices.[30] Data was incredibly valuable: the state had no statistics on its own food production, nor was it clear how many people lived in Britain or if the population was rising or falling.[31] The MP and statistician John Sinclair (then president of the Board), designated the increased cultivation of the potato as the main safeguard against wheat failure and famine in 1795.[32] As he had done with his *Statistical Account of Scotland* Sinclair gathered and compiled much of this data himself, inviting communications on 'the result of any experiments which may have been tried in regard to any particular connected with either the cultivation or the use of this valuable root.'[33]

While the Board hoped to compile the best methods for potato cultivation, its immediate aim was merely to get a sense of how much food the country produced. The collection of data depended on the willingness of parishes and magistrates to respond to questionnaires. The citizen contribution seemed to be limited to gentlemen, local ministers, and trusted friends of the Board; but in practice it immediately became apparent that the cooperation and help of small-hold farmers, if at one remove, would be necessary. The result was a profoundly varied and diverse set of responses, some including detailed statistics on yields, while others included philosophical and speculative reflections on the causes of crop failures. Some respondents even had printed their own forms of the collection of data in their area [figure.2].[34] But the questionnaire raised as many questions as it ever provided answers. Some refused to return any information on 'the fallacious data of the present moment.'[35] Others returned figures 'by conjecture.'[36] In one area, the farmers held a meeting before reporting where it was 'unanimously agreed' to omit figures on oats—no explanation was provided.[37] In other areas, the data was incomplete because 'the principal growers of grain within this parish did not attend the vestry.'[38] Some felt that farmers could only be expected to falsify data, 'his interest is so materially concerned to make the scarcity appear greater than perhaps it is.'[39] Other respondents stressed that they had improved the data returned by speaking with fewer farmers, and contacting only 'the most respectable and intelligent.'[40] Others feared political grounds for misreporting data. As one commented of the farmers in his area, 'half of them *being Republicans at heart.'*[41] The fears of republicanism in rural areas had credence; the French tricolour was later observed in some of the rural food riots of the 1820s and 1830s.[42] The collection of data was also tied to fear. One magistrate recounted being confronted by a mob over bread prices, writing that 'they told me it was agreed, before they came from home, not to take any step till they had first heard what I could do for them.'[43]

The threat of violence was very real and was linked to rapid shifts that rural economies were undergoing at the end of the eighteenth century. In the 1790s, Britain witnessed a spike in rural population growth, contributing to the popularity of the so-called 'Speenhamland system' – a supplement to the poor rates that placed a burden on farmers not employing labourers, resulting in lower wages and falling productivity.[44] Despite modest rises in labourer's wages during the wars years of 1793-1815, on a whole, real wages fell in Britain between 1760 and 1834.[45] The fall in wages wasn't the only pressure being placed on the poor at this time. Between 1750 and 1850, Britain saw 25% of its cultivated area enclosed by parliamentary acts—the majority of these acts occurred between 1793 and 1815, crippling small farmers.[46] The Board of Agriculture was seeking to compile data on agricultural production at a point when those citizens that could provide the data were, in places, on the brink of revolt. The (usually wealthy) correspondents with the Board still depended upon communication with poorer farmers to provide the desired data; and these were connections fraught with political tension.

The first circular of 1795 didn't ask for information on potatoes, but some respondents still included data or observations in their reports. One landowner reported an increase in potatoes between 1794 and 1795 of '180,000'—but the unit of measurement was unclear (the secretary underlining the figure with a question mark).[47] Thomas Whiteheade from Preston reported that while the corn crop had failed from Preston that 'Potatoes are very good'.[48] Others shared the positive reports on potato crops in 1794 and 1795.[49] The 1795 report produced from the data included twenty communications of experiments from agriculturists and scientists, as well as an official guide divided into fourteen chapters on cultivation. In the search for what caused curl, the Board followed farmers in blaming cultivation practices. On the subject of the curl, the Board learned that the 'distemper' of the potato was unknown at altitudes of 400 ft and above in West Lothian, but that seed potatoes brought from this district to lower altitudes and the south became affected.[50] For a plant that was believed by many to have originated in the highlands of Peru, growing it at low altitudes seemed a likely cause of such disease.[51] The authority trusted by the Board (Mr Somerville), suspected that the curl was caused by the use of lime and ash-dung, noting that districts that didn't utilise such practices seemed unaffected.[52] Led by practices in northern England, the Board determined that the curl was largely caused by forcing plants taken from sets that had been improperly manured. Geography guided their deductions. The curl was never found in moss or peat land, it had not affected Yorkshire nor 'the mountains of Radnor and Montgomery.'[53] Out of these details, the Board hoped it had set forward a potential pathway to controlling or mitigating against the distemper. But the domestic sphere wasn't viewed as having the final word. In 1797, the Board began to fund the translation of papers on potatoes from France and Germany for the consumption of its members.[54]

The Board wanted data on potato cultivation with an aim to understanding their potential and current responses to climate: but initial efforts to collect meaningful data were mixed. In 1800, a circular was distributed again in order 'to Obtain a body of Evidence the most authentic' on agricultural production during the bad year.[55] Unlike the circular of 1795, the 1800 circular requested the bushels of potatoes harvested be included in the returned data.[56] Price-fixing riots occurred throughout England from 1794 until 1801; having accurate data was no longer a question of understanding what Britain was producing, but also as a means of repudiating allegations that the government was overlooking profiteering.[57] Numerous responses indicated that potato cultivation had greatly increased, although yields were mixed.[58] The rising prices of bread and corn, as in 1795, increased dependence on potatoes, but the

Board's effort to measure the production of potatoes by price was naïve; as one farmer explained in response, 'few potatoes are grown in this district for sale.'[59] Others made similar observations 'potatoes are only produced on small parcels…the crop hath generally failed.'[60] Another farmer called potatoes 'a failing crop', remarking that they were 'not much cultivated here.'[61] Few provided actual data; one farmer reported that he had harvested 500 bushels of potatoes in good years but had averaged 350 to 400 in 1800 (including no mention of acreage).[62] 'Our crop of potatoes will be small,' a correspondent from Gloucester warned.[63] Another commented merely 'Potatoes—very few grown, very indifferent—much injured by the weather.'[64] The failures also caused interest in switching to different staples. 'There has been no attempt, as yet, immediately in this neighbourhood, to substitute on any general plan, rice, barley, or oats for wheat. But it is now in contemplation.'[65] Instead of data, the Home Office sometimes received arguments and essays. A respondent from Dover omitted any calculations of crops, but observed that 'Had the present scarcity been owing to an increase of population, it would have been gradual.'[66] The scarcities were viewed, instead, as having been caused by new practices and cultivation methods, which were regarded as producing 'one fourth less…than under the old method.'[67] Such responses show that while the Board sought mere numbers on agricultural yields, the farmers that responded viewed cultivation methods as making those numbers intelligible and meaningful.

Seeds, cultivation, and early varieties

The Board didn't seek to compile differences on cultivation practices across the country; but they did take a keen interest in how different regions tried to adjust their methods in order to eliminate the disease. And while most practices focused on the ripeness of the seed potatoes used, other regions sought to avoid the disease through cultivating new varieties. In their survey of West Lothian in 1795, the Board reported they had learned that many farmers raised potatoes from the apple, 'which requires two years to accomplish.' The practice was adopted due to 'The disease of *curling*' for which there was no cure known 'but that of changing the seed.'[68] Cultivating new varieties from the 'apple', or from seeds, was also crucial to developing so-called 'early varieties', or potato varieties that could be grown for harvesting in the spring. With the government increasingly interested in viewing the potato as a substitute for wheat, the cultivation of early varieties became politically important. But not all agriculturists believed that 'early varieties' even existed, as an exchange between the Board and the House of Commons in 1801 reveals. After the crop failures in Britain and Ireland in 1800, the Board established a sub-committee that very winter which would be charged with purchasing eyes and sets of potatoes to conduct research into the best varieties.[69] The public, confused by the price rises that came right after the harvest, suspected that hoarding and price fixing were to blame.[70] Immediate actions were viewed necessary to avoid riots. Shortly after the formation of the committee, Parliament requested that the Board work immediately to accumulate a supply of cuttings for early variety potatoes to relieve potential shortages that spring. But the Board was unwilling to meet the request:

> Resolved that this committee cannot recommend to the Board to submit to the Com. Of the House of Commons the offering of any Premiums for the Cuttings of what are called *Early Potatoes*, this committee believing that a sufficient quantity, to be a considerable object in the national consumption, cannot by any means be procured by general cultivation.[71]

In other words, the members of the Board were sceptical of the stability or existence of a true variety of 'early' potatoes. When the House of Commons pressed the Board to advise immediate planting of potatoes, the Board refused, fearing that doing so would endanger next year's wheat crop.[72] But the Board wasn't united in its position. Thomas Andrew Knight, who would in the next decade become president of the Horticultural Society of London, believed in the possibility of breeding early varieties, and he would use the publications and the network of the Society to dominate approaches to the cultivation of potatoes in the first two decades of the nineteenth century.

For those that believed that true early varieties were tenable and stable, it was still expensive and time-consuming to attempt the development of such varieties by seed. For the farmer interested in joining the movement to cultivate new varieties in the 1800s, *A Treatise on the Culture of Potatoes* warned that: 'it takes full three years to form an adequate judgment of Potatoes raised from seed, and, after all, if one in ten succeed so as to be worth preserving, it is as much as can be reasonably expected.'[73] Raising new varieties was limited to farmers with the means to invest in such projects, but a patriotic service was attached to such ideas. Among the farmers that began to compete for fame as producing the best new varieties that would prove free from the curl, one in particular, Thomas Andrew Knight, utilised the newly-established Horticultural Society of London to promote both the inevitability of degeneration in potato varieties and the superiority of his new breeds.

The Horticultural Society of London, founded in 1804, was small— it boasted a few dozen members and would not succeed in publishing the papers from its meetings until 1818. But Knight, becoming president of the Society in 1811, viewed it as a means through which he could educate the public in his ideas on plant physiology and thereby justify the adoption of his own varieties. Knight argued that curl was a product of the prolonged cultivation of the plant; and that the symptoms of curl were in fact inherent in the potato plant and even signs of quality.[74] The danger lay in artificially propagating potatoes year after year by harvesting and then replanting seed potatoes. This practice meant that there was, in fact, just one aged potato plant being grown throughout many parts of the country, growing older and more feeble by the year.[75] Knight first issued this warning as concerned the practice of propagating fruit trees by grafting in 1795.[76] But potato cultivation appeared to Knight to suffer from the same flaw as propagation by grafting—there were no new individuals created one year from the next. As Knight argued: 'The fact that every variety of potatoe when it has been long propagated from parts of its tuberous roots becomes less productive is, I believe, unquestionable.'[77] How long could such an individual plant endure? Popular belief during Knight's lifetime was that three to four years after being bred from seed were peak years for a variety, which would be largely exhausted after fourteen years of cultivation.[78] Agriculturists regularly attributed the decline in cultivation of some varieties to their age. As a farmer in Ireland commented in 1834, 'The black potato, which about twenty years since possessed more good qualities than any other which we have ever seen, is now so far degenerated as to be seldom seen.' When Scotland saw devastating failures in 1837 (discussed below), the secretary of the Highland and Agricultural Society of Scotland, Charles Gordon, sent a questionnaire to its members asking '*whether the plant be weakened or worn out*, and whether it is expedient to cultivate it more by means of the *apple,* and less from the root, than has of late been in use.'[79]

The continued attacks of curl and the urgent need for early varieties provided all the motivation necessary for Knight to argue that the cultivation of new varieties, rather than investigating the practices used by farmers across the country, was the sole means of addressing the problems facing the nation. Following Malthus, Knight conceived of economic value as coextensive with the state's production of its own food. By improving plants, an increase of wealth could be obtained, 'without any increased expense or labour.' An increase in the productivity of a variety would have the same financial benefit as the farming of poor or barely usable land, with immediate and obvious benefits to the state. In 1810, Knight reckoned that an acre of potatoes provided the same amount of food as forty acres of pasture. [80] The economic aspect was a point of contentious debate. One of the most common proposals during this period to avoid revolution and unrest in Britain was 'to provide the poor with land.' Arthur Young had advocated for such a policy even before the war.[81] The desire to expand the farming of waste lands were embodied in Pitt's calls for 'home colonisation', speculative schemes that hoped to reclaim waste land and settle Britain's poor there.[82] Knight shared these concerns but promised instead a greater return from land already in use. Cultivation practices were important, but for Knight, the practices to imitate were those used on his own farm, in the production of new varieties. On his side was the president of the Royal Society, Joseph Banks, who envisioned Knight's new potato varieties being freely distributed to all members of the Society.[83] Knight himself would regularly communicate varieties that he had bred himself with the aim of supplying the farmer with a reliable mix of seed-stock for year-round cultivation, always working to produce genuine early varieties.[84] Over the years, Knight produced over twenty such varieties, all of which were distributed through the Society. The continued production of such varieties—which were ascribed numbers instead of names—implies that Knight was never convinced that any of these were genuinely trustworthy early varieties, but alongside the production of these seeds, the society was also developing a means of testing them.

Breeding new early varieties was particularly difficult, because Knight believed as a rule that early varieties of the potato 'never afford seeds, nor even blossoms; and that the only method of propagating them is by dividing their tuberous roots.'[85] The opinion was popular and long-lasting—William Cobbett affirmed the same opinion in 1830.[86] This condemned most existing early varieties to degeneration within Knight's system, as to divide the roots would be to populate one's field, year after year with the same, ageing, individual plant. Seed from early varieties, being unavailable in Knight's experience, meant that new early varieties must always be developed from breeding with late varieties, making the search for new varieties all the more difficult. One solution lay in importing early varieties from Peru, where many believed that the potato must exist in a far superior state. By the 1820s, the Society had established an experimental garden. A bad frost that destroyed early crops of potatoes throughout Britain in 1821 deeply troubled the Society, but it placed great hopes on the promise of new varieties being developed both by Knight and being imported from abroad.[87] In 1822, it was able to acquire a specimen of the much sought-after Lima (or Golden) potato from Peru. The arrival of the root promised not only the highest quality potato described in any travels, but the possibility of producing new varieties that would not demonstrate the tendency to curl. The potato, however, clearly did not live up to expectations, with the society commenting that:

> It is a late kind, and an indifferent bearer, when grown in a strong soil, but tolerably productive in a lighter. Though very good, this anxiously expected root has not turned out of such extraordinary excellence for the table as was anticipated, nor answered the expectations which the extravagant accounts of travellers in South America had induced us to form of it.[88]

The Lima was never circulated by the Society; the aim in the 1820s remained to provide early varieties.[89] Knight boasted tremendous yields of his own new varieties in the pages of the *Transactions,* leading to accusations from the editor of *The Gardener's Magazine* (discussed below) that he was inventing figures. The result of the charge was the first experiment that the Society had ever conducted to gauge whether or not Knight's early varieties were indeed, early or better than the older varieties used in Britain. Conducted by John Lindley in 1831, twenty of Knight's varieties were tested against established varieties, producing a table of the results that showed a few decent varieties had been developed by Knight, but also that the promise of confronting disease and the demand for early varieties by breeding had not produced a quick fix for the country [see figure.3].[90]

Collecting and diffusing experiments: citizens, gardens, and data

Knight represented a sole point of (aristocratic) authority. By the late 1820s, Knight's attempts to control the direction of agricultural practice through the *Transactions* had been undone by the emergence of editors and agriculturists that believed farmers and gardeners already possessed the knowledge needed to stabilise the cultivation of potato plants—all that was needed were structures and networks to compile and diffuse this knowledge. When the gardener and editor John Loudon introduced *The Gardener's Magazine* in 1826, he was explicit in his opposition to Knight and the Horticultural Society's approaches:

> A magazine has this great advantage over collections of papers in what are called Transactions, that it admits of controversial discussion, which the latter do not; and therefore false doctrine, once admitted into such collections, stands there as true. In this respect, the Transactions of societies, in their present form, and in their present manner of publication, are behind the age. Fortunately the bulk and expense of these works prevent them from being generally read.[91]

Materially, *The Gardener's Magazine* was profoundly different from the *Transactions.* Sarah Dewis has pointed to the price as a means of gauging the different approach taken by Loudon. The *Transactions* cost £1 1s 6d for the public, and the rate for members was largely similar. It enjoyed a circulation of around 2,000 copies, but these were printed at irregular intervals. *The Gardener's Magazine* aimed to provide a cheap, accessible library for practitioners. Shifting in format during its early years, it gradually evolved into a monthly journal of 50 pages priced at 1s 6d.[92] The paper technologies utilised in the production of journals like *The Gardener's Magazine* constituted a radical shift in organising cultivation knowledge. Crucially, *The Gardener's Magazine* and similar publications lent authority to a diverse class of actors: gardeners. As Clare Hickman has observed, gardeners came from diverse backgrounds, wielded academic and practical authority, and played an increasingly crucial role in knowledge networks that spanned botanical gardens, universities, farms, and estates.[93] Where Knight and Banks had both hoped to establish a system whereby new varieties were developed on farms of members of the Society and then distributed, Loudon remained focused on compiling and diffusing cultivation practices from those that owned land and also those merely employed to work it. He maintained that Knight's reported yields on his new varieties were impossible because Knight disclosed few details about the cultivation methods he employed.[94] In practice, Loudon regarded good varieties of plants as useless without knowledge of the cultivation practices and provenance. Observing specimens of an early variety cultivated by a farmer in Penzance at a Horticultural meeting, Loudon lamented that there was no accompanying information on 'what circumstances of culture, locality, or variety' had been employed.[95] Without such knowledge, Loudon viewed the specimens as incomplete and of no use to his readers.

The crises that drove interest in cultivation data in the 1790s didn't disappear with the cessation of war with France in 1815. The end of the Napoleonic wars witnessed new economic problems and a rise in farmworkers taking part in generalized riots over wages and food prices.[96] There were several significant failures brought on by disease in Scotland, Ireland, and England. Local failures were common.[97] Outside England, there was starvation and famine.

Scotland saw blight and widespread failures in 1833, and again in 1835, 1836, and 1837.[98] Ireland saw failures in 1816-1818, 1822, and 1831.[99] The 1820s were characterised by a prolonged agricultural depression, and 1830 saw the occurrence of the Swing Riots, with widespread machine-breaking throughout the country, including a quarter of all the threshing machines in Wiltshire. Within rural areas, protests to the stagnation in wages and rising food prices took many forms: 'arson, animal maiming, and […] sheep stealing' all occurred at regular intervals throughout the country.[100] Thus, the emergence of journals like *The Gardener's Magazine* (1826) and later its imitator *The Irish Farmer's and Gardener's Magazine* (1833) were accompanied by the threat of rural revolt and by continued failures in potato crops, many of them severe, placing renewed pressure on the belief that adopting a scientific perspective was essential to avoiding disaster. As one observer commented in the case of the Scottish failures of 1835, 'The extraordinary state of the potato crop merits notice from the naturalist as well as the farmer. In some fields there is not one single plant.'[101] What, precisely, would the naturalist deduce? The author of the article ruled out climate and poor weather—improper cultivation methods, he argued, were the cause of the appearance of disease. Such views were not only common, but integral to the motivations and rationale behind collecting and diffusing cultivation methods in journals like Loudon's.

From 1826 until the final issue in 1843, *The Gardener's Magazine* included regular communications on cultivation methods that were either blamed for causing curl or advertised as ensuring its absence. The dangers of failure with early crops were particularly high, and communications on how to cultivate potatoes successfully in the colder months were highly valued by Loudon. In the first year, Loudon included a communication from a farmer in Lancashire who advanced a theory on the eyes that remained significant for many decades: 'It is well known in Lancashire,' the farmer R.W. explained, 'that different eyes germinate and give their produce, or become ripe at times varying very materially, say several weeks, from each other.'[102] Communicating an illustration of the theory [figure.4], the farmer explained that in Lancashire, the eyes from section *a* of the potato were soonest ripe, and could be used to grow an early crop – but the eyes from *c* and *d* would grow several weeks later, and were also more prone to disease. Suspicion of the positioning of eyes remained a feature and became a regular means by which the appearance of curl could be blamed. As one gardener advised in 1832, 'Generally, at the root end of the potato… there is an eye, which, cut by itself, mostly produces a curl.'[103] Explanations like this reinforced suspicion that failures and disease were evidence of a mis-step in cultivation practice on the part of the farmer. Cutting practices were, at the same time, connected intimately with the appearance of disease. 'I am of opinion that in nine cases out of every ten the disease [dry-rot] will be found to have commenced on or near the part of the tuber that had been attached to the stalk,' wrote an Irish farmer after the failures of 1833.[104] Cut the seed potato one way, and an early variety was produced; but cut another way, dry-rot and curl would attack the plant. Loudon's efforts to collect and diffuse experiments were working—farmers were reading his publication and not only communicating their methods, but were also explaining how their approaches differed or matched those of other correspondents.

The stakes were much higher with the potato failures of 1831-1833 in Ireland than they were when such failures occurred in England. Where the English poor law encouraged movement towards wage labour, in Ireland where no such law existed, land provided the sole security.[105] Inspired by Loudon's *Magazine,* both catholic and protestant members of the RDS, led by the reverend and agriculturist William Hickey, established *The Irish Farmer's and Gardener's Magazine* in 1833, with an aim to addressing the failures.[106] The RDS was, at that time, a 'relatively non-sectarian and non-political body.' Once the leading institution for education and agricultural development in Ireland, by 1800 its contributions to agriculture no longer stretched far beyond the boundaries of Glasnevin's botanical garden.[107] Still, Glasnevin, alongside Edinburgh, was an important site of botanical science in the late-eighteenth century, and the gardeners that operated these gardens held authority both in academic and agricultural networks.[108] While small, the society was growing during these years—in the 1830s its membership grew from roughly 300 to 700.[109] Its funding from the British government may have been dwindling, but its importance and its ability to communicate to both protestant and catholic farmers gave it importance.

Within the pages of the *Magazine,* the scrutiny fell upon seed potatoes and the cultivation methods of others. As in England and Scotland, it was common for parishes in Ireland to import potatoes 'in order to change the seed, as it is called.'[110] Drawing on *The British Farmer's Magazine,* Hickey warned his readers that practices abroad were potentially producing seed potatoes that would inevitably fail. In the neighbourhood of Liverpool, sea-tang was used instead of manure; a practice that, Hickey suggested, could be linked to the failures witnessed in Ireland.[111] Over thirty such communications and observations featured in the first two issues alone. Alongside fears that improper cultivation methods were causing degeneration in the potato, those with access to scientific instruments also contributed experiments and theories to the press. One farmer reported observing 'small white particles, like eggs' when putting potatoes from a failed crop under the microscope. For the contributor, the experiment suggested that there were airborne animacules that could attack potatoes.[112] And yet, such attention to insects didn't rule out the opinion, held by many, that insects only appeared once a plant was ill—'the appearance of insects on the leaves of trees, *&.c,* is the symptom of *incipient disease,'* as one farmer wrote.[113] Suggestions that the disease could have natural causes, or arise from factors largely outside of the farmer's control, were often dismissed in this way.

Because there were seldom any clear external causes, the minute differences in cultivation practice from farm to farm were increasingly scrutinised and regarded as the cause of disease and failure. Speculation included focus on 'Unripeness' in the 1832 crop, fermentation in the potato store, the use of dung, contact with salt-water, 'animalculae found in and about the rotted silt'—commenters traced the life of the seed potato from its harvesting to its planting in the hopes of identifying stages that could be meaningfully linked to the appearance of curl in the mature plant.[114] Failure provoked scrutiny on particular varieties. Practice shifted in Ireland during these years; far fewer farmers risked cutting their seed potatoes, and the relative absence of disease reinforced beliefs that cutting led to deterioration and degeneracy in the plants.[115] One farmer attested that Bangor potatoes must be planted when the top shoot appears, otherwise weaker shoots will grow in its place, producing a weaker plant; but for the Pinkeye variety, these multiple shoots were desirable and important to developing a strong plant.[116] Maintaining the same cultivation methods, farmers measured the degree of failure between various varieties, submitting tables that represented the inclination towards the curl as represented across different varieties [figure.5]. Small experiments like this – and the production of tables—allowed agriculturists to test many of the anecdotal pieces of advice that floated through the guides and manuals on cultivation. In this way, periodicals not only encouraged cultures of experimentation, but they also encouraged closer attention to fine distinctions in cultivation methods, the very kinds which increasingly were identified as the causes of disease.

A similar case to Ireland can be see a few years later in Scotland. While curl commanded the most attention, once journals began to collect and compile data on potato cultivation, an array of other diseases and conditions became known. After the failures in Scotland in 1837, the agricultural press provided an unprecedented means of information-gathering. Never before had so many farmers and agriculturists communicated their observations and experiences. Compiling this data for the Highland Horticultural Society, Charles Gordon, the secretary of the Society, commented that:

> A great mass of valuable information has been communicated, and the opinions of practical men residing many miles apart, are now to be arranged in juxta-position, so as mutually to confirm and illustrate each other; their joint influence, being the result of no common understanding, and suggested by no previous intercourse, ought, therefore, to induce attention to their counsels.[117]

Gordon's report compiled the communications of thirty-seven farmers in Scotland. The report drew almost universal agreement on the age-old question of cutting. Summarizing the communications, Gordon explained that 'The entire potato has not been known to fail…The cut potato, exposed or planted, is frequently known to rot.'[118] Gordon found that one-third of the cultivators believed cultivated varieties were degenerating with age, with only one-sixth insisting that varieties do not deteriorate over time. Still, the entire report traced the probable causes of curl and dry rot to differences in cultivation: the only potential causes of the diseases considered in the report are the period of planting, the period of lifting (ripe or unripe seed), preserving and storing seed potatoes, soil density and preparation of ground, the use of dung, cutting or planting whole, and the question of exhausted varieties. One farmer believed that curl had been introduced by cultivation from seed, and that it was a product of improper plant breeding.[119] In either case, crop failures were now veritable mines of information and data: farmers could be relied upon to communicate their practices and methods to journals and societies. The editors and secretaries of these societies were also now compiling these observations and experiments, seeking to uncover common experiences and errors in cultivation that might be linked to the appearance of disease. However naïve, the belief on Gordon's part that these farmers had 'no common understanding' gave the reports a greater degree of authenticity. There was no danger of suggestion or bias.

Alongside fears of being overwhelmed by data, there were also fears that the strategies adopted in response to curl could undo the practices that farmers relied upon to identify and develop varieties. The severity of the failures in Scotland renewed discussion of breeding new varieties. When the *Highlands Agricultural Society* decided to hold a competition in 1837 to reward any farmer that could uncover means to increase the preservation of potatoes. The agriculturist Mackenzie criticised the competition, remarking that all the known varieties decayed. The proper competition ought to "offer one [a prize] for raising new varieties, and producing one or more with as many as possible of the qualities which a potato is desired to possess."[120] While the dangers of relying on one sole variety were known, so too were farmers aware of the dangers in losing control over the promised traits and attributes of the plants that they relied upon. Farmers began to fear that the multiplying crises would lead to an increased effort to breed new varieties from seed thus filling the markets with 'a heterogeneous assemblage of potatoes, from which it will be difficult to select any required valuable kind.'[121]

In early 1843, reports began to emerge from Cornwall that of a new disease that halted all growth in potatoes above the soil level.[122] The editors of the newly-established *Gardener's Chronicle* (edited by John Lindley) called for experimentation with ammonia for those affected.[123] Shortly after the initial report was published, the Probus Farmers' Club in Cornwall met to discuss the disease. Investigations revealed that in Penzance the disease had destroyed over one third of the crop, and that local farmers referred to the disease as 'Bobbin-joans'. For agriculturists familiar with the approaches that had developed in these journals over the last two decades, attention focused on whether or not Bobbin-joan could be ascribed 'to the soil or the seed?'[124] But the climate wasn't unusual that year, and farmers next season determined to test the soil by experimentation. Seed potatoes were taken from a field where Bobbin-joans appeared and planted in an unaffected field: there were failures. The same farmer took fresh seed and planted it in an affected field – noting that these grew without any signs of illness.[125] Was this symptomatic of poor cultivation, was it a sign of degeneration in the variety? John

Lindley himself commented on the disease that 'When potatoes degenerate, they produce tubers of bad quality, but not Bobbin-joans.'[126] Still, attention focused on how seed potatoes were selected and preserved in Cornwall. One agriculturist commented that:

> I have also noticed similar results and much absolute failure when the seed Potatoes have been exhausted of their natural moisture, by improper modes of keeping, by fermentation in the Potato-house, and by being suffered to exhaust their strength by premature growths, &c. Whether any of these causes operate to the production of 'Bobbin Joans' in Cornwall, I cannot say.[127]

For Charles Lemon, suspicion came to rest on seed potatoes having been stored when damp, and prone to fermentation. Debates over the causes of Bobbin-joans continued within the Probus Farmers' Club, but its members were split over the possibility of degeneration and the potential impact of poor seed preservation and cultivation methods.[128]

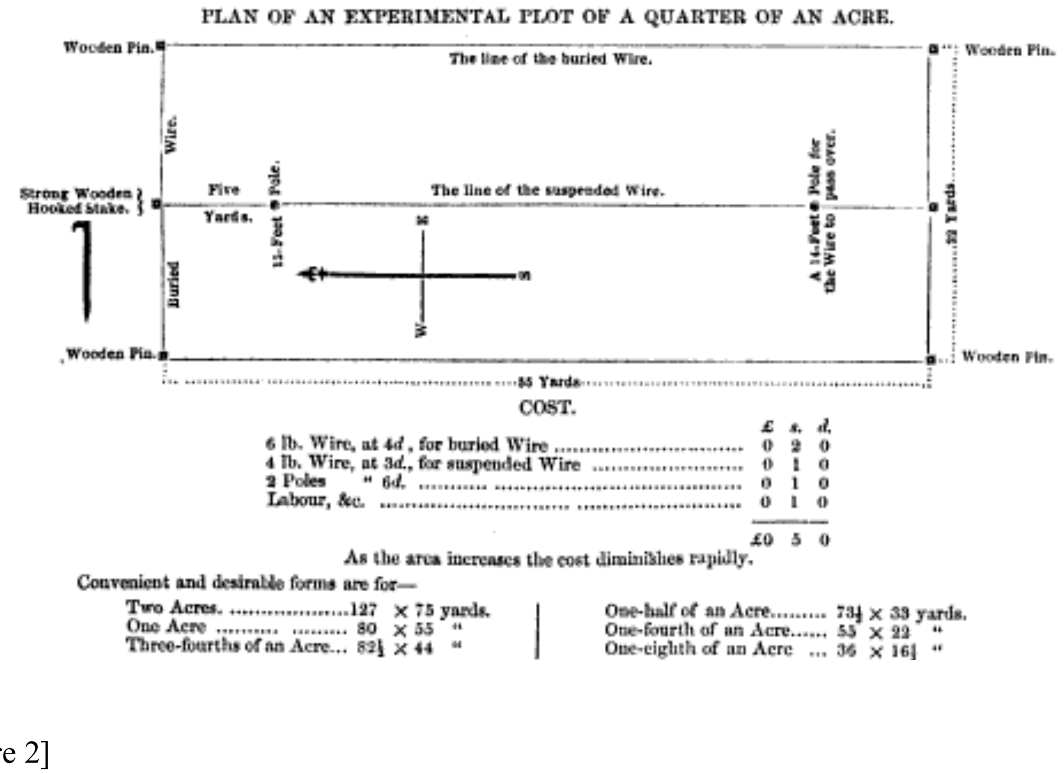
The appearance of potato blight in 1845 led to a quick loss of interest in the contained outbreak of Bobbin-joans. But precedents were needed to understand the new disease attacking crops in Ireland and Scotland, and Bobbin-joans was recalled as an example pointing towards the dangers of seed selection. During the Bobbin-joans outbreak in Cornwall, as the editors of *The Gardener's Chronicle* observed, farmers had continued to use the surviving potatoes from sets affected by the disease. These proved to carry the illness somehow, leading the editors to declare that 'We now, therefore, warn the public that *diseased sets will produce a diseased crop*. Not a shadow of doubt remains upon that point.'[129] *The Farmer's Magazine* in 1846 warned that 'The Produce of Diseased Potatoes will be Diseased,' and cautioned farmers that would be rash to regard sets that were unaffected by Bobbin-joans as also free of the disease. *"great doubts exist as to the fitness for seed of apparently sound potatoes from diseased districts*." [130] Even healthy-looking seed could prove diseased; there was no art of observation that could detect the incipient failure.[131] At the Farmer's Club in the autumn of 1846, the veterinarian William Karkeek claimed that he had been studying Bobbin-joan for several years in his region. In that time, he had noted that potatoes left in the ground by accident were never infected—could it not potentially be the case that 'digging up potatoes in the autumn, and keeping them half the year in pits and others places, foreign to the natural habits of the plants,' was the cause of both Bobbin-joan and the *murrain*? Suspicious that 'fungi and insects' could be credible causes of any disease, Karkeek reiterated the power of heredity at work in the human, animal, and vegetable realms. [132] Somewhere, in the artificial practices that cultivators used to propagate the plant, lurked the origins of the diseases that ruined crops and threatened famine.

Conclusion

As diseases like the curl progressed through the country, all cultivation became potential sites for experimentation. A field unaffected by disease was an object of interest and scrutiny: a field ruined by disease brought the farmer's practice and methods under minute examination. As I argue here, the majority of agriculturists and farmers that communicated to journals and societies believed that the diseases that afflicted potatoes were themselves products of poor cultivation methods: reform in practice would serve as the principle means of avoiding any disaster. In this way, generations of farmers and cultivators invested in their work a patriotic service. Reforming cultivation practices would improve the variety cultivated, and mitigate against the appearance of diseases in the future. The appearance of potato blight interrupted this citizen-led project by adding complexity to the relationship perceived to obtain between disease and cultivation. In its universal destruction, it proved impossible to attach blame to any practice in the fine detail as so many farmers had done with curl and dry-rot. 'Fungi and insects', causal agents rejected by figures like Karkeek, became more important after 1846 in understanding the origins and causes of disease. More work needs to be done to understand how relationships between cultivation methods and disease were understood in the decades following the appearance of potato blight. This article, in exploring cultures of experimentation on potatoes and fears of disaster in the decades leading up to the famine, has attempted to show that this moment in agricultural history is not only crucial to the role played by data production and collection in botany and the agricultural sciences, but also that these sources provide new ways of assessing how the public in the early nineteenth century understood the impacts of agriculture and the art of cultivation upon nature.

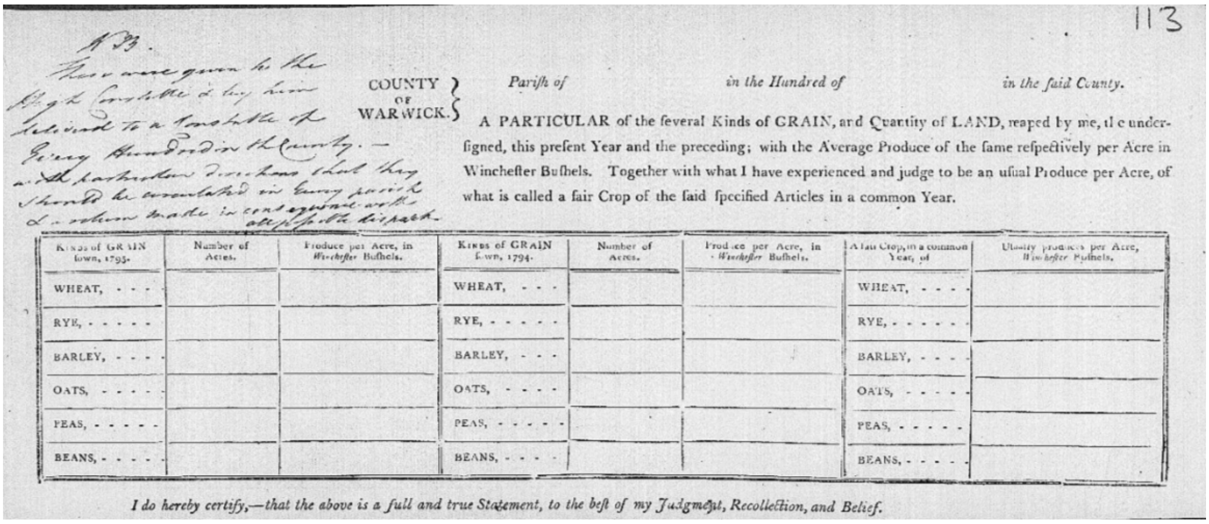
Images:

[Figure 1]
'An illustration produced by Robert Forster of his method for introducing electrical currents into cultivated fields.'
(John Joseph Mechi, *A Series of Letters on Agricultural Improvement: With an Appendix.* London: Longman, Brown, Green, and Longmans (1845), p.89).



[Figure 2]

'The form devised and printed in Warwick that was used to aid efforts to gather agricultural data in 1795'
(Papers of the Home Office: Domestic Correspondence, George III, 1782-1820. Held at the National Archives, Kew. HO 42/36/113).



113

N 33.
These were given to the High Constable & by him delivered to a Constable of Every Hundred in the County.— with particular directions that they should be circulated in Every parish & a return made in consequence with all possible dispatch.

COUNTY OF WARWICK. Parish of in the Hundred of in the said County.

A PARTICULAR of the several Kinds of GRAIN, and Quantity of LAND, reaped by me, the under-signed, this present Year and the preceding; with the Average Produce of the same respectively per Acre in Winchester Bushels. Together with what I have experienced and judge to be an usual Produce per Acre, of what is called a fair Crop of the said specified Articles in a common Year.

Kinds of GRAIN sown, 1795.	Number of Acres.	Produce per Acre, in *Winchester* Bushels.	Kinds of GRAIN sown, 1794.	Number of Acres.	Produce per Acre, in *Winchester* Bushels.	A fair Crop, in a common Year, of	Usually produces per Acre, *Winchester* Bushels.
WHEAT, - - -			WHEAT, - - -			WHEAT, - - - -	
RYE, - - - - -			RYE, - - - - -			RYE, - - - - - -	
BARLEY, - - - -			BARLEY, - - -			BARLEY, - - - -	
OATS, - - - - -			OATS, - - - -			OATS, - - - - -	
PEAS, - - - - - -			PEAS, - - - - -			PEAS, - - - - - -	
BEANS, - - - - -			BEANS, - - - -			BEANS, - - - - -	

I do hereby certify,—that the above is a full and true Statement, to the best of my Judgment, Recollection, and Belief.

[Figure 3]

'The table produced by John Lindley, showing the results from the Horticultural Society's experimental farm which sought to compare the yields produced by Knight's varieties (26-45) with established varieties.'
(John Lindley, 'The Result of some Experiments on the Growth of Potatoes, tried in the Garden of the Society in the year 1831.' Series 2 v.1 (1835), pp.153-161, p.155).

Table A.

No.	Name.	No. of roots planted	Weight planted. (lb. oz. dr. drams)	Number taken up: Large	Number taken up: Small	Weight taken up. (lb. oz. dr. drams.)	Produce per acre. (lbs. tons cwts. lbs.)	Rate of increase.
1	Early Walnut-leaved .	2	0 2 4 or 36	12	1	3 15 0 or 1008	9,718 or 4 6 86	1 : 28.00
2	Early Manley . . .	2	0 7 9 — 121	30	6	5 0 0 — 1280	13,610 — 6 1 58	1 : 10.57
3	Shaw	2	0 2 8 — 40	7	1	1 7 0 — 368	3,913 — 1 14 105	1 : 19.20
4	Early Flat White . .	2	0 1 9 — 25	5	4	1 13 0 — 464	4,934 — 2 4 6	1 : 18.56
5	Hâtive de Juin . . .	2	0 2 3 — 35	10	6	3 11 0 — 944	10,039 — 4 9 71	1 : 26.97
6	Philadelphia	2	0 1 8 — 24	6	4	1 8 8 — 392	4,168 — 1 17 24	1 : 16.32
7	Early Kidney . . .	2	0 3 5 — 53	14	9	3 4 0 — 832	8,848 — 3 19 0	1 : 15.66
8	Yellow	2	0 2 0 — 32	9	10	2 1 0 — 528	5,615 — 2 10 15	1 : 16.50
9	De Hollande Jaune .	2	0 2 1 — 33	7	8	1 1 0 — 272	2,892 — 1 5 92	1 : 8.24
10	Cornichon jaune dit la Parmentier .	2	0 1 13 — 29	9	5	1 3 8 — 312	3,318 — 1 9 70	1 : 10.75
11	Jaune Blanche . . .	2	0 2 4 — 36	5	4	1 6 0 — 352	3,743 — 1 13 47	1 : 9.75
12	Wellington	2	0 1 13 — 29	6	1	1 4 0 — 320	3,403 — 1 10 43	1 : 11.03
13	Blue red marbled . .	2	0 1 8 — 24	6	—	1 4 0 — 320	3,403 — 1 10 43	1 : 13.33
14	Violette de M. Sageret	2	0 2 8 — 40	5	2	1 1 0 — 272	2,892 — 1 5 92	1 : 6.80
15	Onion	2	0 1 4 — 20	13	8	2 4 0 — 576	6,125 — 2 14 77	1 : 28.80
16	Old Apple	2	0 1 13 — 29	7	—	1 3 0 — 304	3,232 — 1 8 96	1 : 10.48
17	Lanckman's red . . .	2	0 2 4 — 36	8	3	2 10 0 — 672	7,146 — 3 3 90	1 : 18.88
18	La Divergente . . .	2	0 2 5 — 37	19	—	17 14 0 — 4544	48,555 — 21 13 59	1 : 122.81
19	La Dégénérée . . .	2	0 1 12 — 28	24	7	7 1 0 — 1808	19,227 — 8 11 75	1 : 64.57
20	Long red Kidney . .	2	0 1 8 — 24	12	9	7 15 0 — 2132	21,609 — 9 12 105	1 : 88.83
21	Holland	2	0 3 0 — 48	5	6	0 13 0 — 208	1,212 — 0 10 92	1 : 4.33
22	Golden	2	0 1 9 — 25	24	25	4 1 0 — 1040	11,060 — 4 18 84	1 : 41.60
23	Pied Golden	2	0 2 1 — 33	12	5	1 11 0 — 432	4,594 — 2 1 2	1 : 13.09
24	À feuilles de Haricot	2	0 3 4 — 52	16	9	6 14 0 — 1760	18,717 — 8 7 13	1 : 33.84
25	Salmon-coloured Kidney	2	0 8 9 — 137	32	25	17 12 0 — 4512	48,324 — 21 11 52	1 : 33.73
26	Mr. Knight's, No. 1.	1	0 9 4 — 144	23	30	10 1 0 — 2576	27,395 — 12 4 67	1 : 17.88
27	. . . . 2.	1	0 8 8 — 136	13	17	15 1 0 — 3856	41,007 — 18 6 55	1 : 28.35
28	. . . . 3.	1	0 6 4 — 100	9	—	1 11 8 — 440	4,679 — 2 1 87	1 : 4.40
29	. . . . 4.	1	0 3 13 — 61	19	8	12 6 0 — 3168	33,691 — 15 0 99	1 : 51.93
30	. . . . 5.	1	0 7 9 — 153	5	3	2 0 0 — 512	5,444 — 2 8 68	1 : 3.34
31	. . . . 6.	1	0 6 4 — 100	27	20	11 4 0 — 2880	30,638 — 13 13 62	1 : 28.80
32	. . . . 8.	1	0 5 9 — 89	8	15	5 10 0 — 1440	15,319 — 6 16 87	1 : 16.06
33	. . . . 10.	1	0 5 9 — 89	13	—	10 2 0 — 2592	27,565 — 12 6 13	1 : 29.12
34	. . . . 12.	1	0 5 13 — 93	15	2	10 8 0 — 2688	28,587 — 12 15 27	1 : 28.90
35	. . . . 15.	1	0 8 8 — 136	21	26	10 5 0 — 2640	28,075 — 12 10 75	1 : 19.41
36	. . . . 16.	1	0 5 0 — 80	27	7	14 6 0 — 3680	39,135 — 17 9 47	1 : 46.00
37	. . . . 17.	1	0 7 8 — 152	26	4	11 12 0 — 3008	32,000 — 14 5 80	1 : 19.78
38	. . . . 18.	1	0 6 1 — 97	10	5	6 13 0 — 1744	18,547 — 8 5 67	1 : 17.97
39	. . . . 19.	1	0 4 0 — 64	20	11	4 11 0 — 1200	12,761 — 5 13 105	1 : 18 75
40	. . . . 20.	1	0 7 4 — 148	24	15	10 6 0 — 2656	28,145 — 12 11 33	1 : 17.94
41	. . . . 21.	1	0 8 1 — 129	19	4	8 4 0 — 2112	22,360 — 9 19 72	1 : 16.37
42	. . . . 22.	1	0 8 4 — 132	15	13	5 4 0 — 1344	14,293 — 6 7 69	1 : 10.18
43	. . . . 23.	1	0 5 9 — 89	9	7	4 12 0 — 1216	12,931 — 5 6 59	1 : 13.66
44	. . . . 24.	1	0 6 0 — 96	21	7	8 10 0 — 2208	23,481 — 10 9 73	1 : 23.00
45	. . . . 25.	1	0 7 0 — 144	8	6	2 1 0 — 528	5,615 — 2 10 15	1 : 3.66

[Figure 4]

'An illustration submitted by the farmer R.W. to demonstrate the position of eyes on the potato that would produce an early variety (and those that should be avoided).

(R.W., ‘Culture of Early Potatoes in Lancashire’, The Gardener’s Magazine 1:2 (1826), pp.405-406.)

[Figure 5]

‘A table produced by a farmer in Ireland demonstrating the relative failures of different varieties due to curl.’
(E.C., ‘On the Potato’, Irish farmer's and Gardener's Magazine and Register, no.1:4 (1834), pp.298-301, p.299).

No.		
1,	Bangors, planted in ridges of 4½ feet, for early use, . . .	Failure, one-tenth of the whole.
2,	Pinkeyes, in drills, under stable dung, dry, but well rotted, for early use, ...	Failure, one-fourth ditto.
3,	Benefits, in drills, under well rotted dung, harvest use,	Failure, one-half nearly.
4,	Cork-reds, do. do. do. do.	Failure, one-half upwards.
5,	Cups, do. do. do. general crop,	Failure, one half nearly.
6,	Brown's fancies, do. do. do.	Total failure.
7,	Apples, (red) do. do. do. for late keeping,	total failure.
8,	Lumpers, do. do. for cattle and pigs,	no failure worth notice.

[1] For Niven’s belief in electrical disturbances, see Ninian Niven, *The potato epidemic and its probable consequences: a Letter to His Grace the Duke of Leinster* (Dublin: 1846), p.19. The experiment is described in John Wilson (eds), *The Rural Cyclopedia, or a General Dictionary of Agriculture,* Edinburgh: A. Fullarton, (1857), pp.915. For descriptions of the method, see ‘Culture by Electricity’, *Chamber’s Journal* 3:76, (June 1845), pp.379; see also ‘Electro-Culture’, *The Chemist,* 6 (1845), pp.313-314

[2] John Joseph Mechi, *A Series of Letters on Agricultural Improvement: With an Appendix.* London: Longman, Brown, Green, and Longmans (1845), p.89

[3] Niven’s ‘experimental garden’ dedicated to potatoes is discussed in Murphy, ‘Observations of the Stirling Agricultural Exhibition’, *Irish Farmer’s and Gardener’s Magazine,* 1 (1834), pp.345-356. Dedicating space in a botanical garden to potato experimentation wasn’t unusual in Ireland during this time. James Drummond, head of the botanic gardens in Cork, had devoted an area to experiments on potato cultivations as early as 1822. See: James Drummond, ‘Account of an Experiment made to ascertain the relative Produce of the Red Apple Potatoe, when cultivated in single or double Drills, or in Beds.’ *Transactions of the Horticultural Society of London,* 2:3 (1822), pp.124-126

[4] Niven 1846 (op.cit.), p.3

[5] Ibid., p.6

[6] Christina Matta, ‘Spontaneous generation and disease causation: Anton de Bary’s experiments with *Phytophthora infestans* and late blight of potato’, *Journal of the History of Biology,* 43 (2010), pp.459–91; J. C. Zadoks, ‘The potato murrain on the European continent and the revolutions of 1848’. *Potato Research* 51

(2008), pp.5-45; see also Austin Bourke, 'Potato blight in Europe in 1845: The scientific controversy.' In Lucas, J.A., Shattock, R.C., Shaw, D.S. & Cook, L.R. (eds), *Phytophthora, Symposium of the British Mycological Society for Plant Pathology and the society of Irish Plant Pathologists held at the Trinity College, Dublin, September 1989*. Cambridge University Press, Cambridge, pp.12-25. The importance of the Irish famine to science in this period has been argued extensively by Ian Miller: see Ian Miller, *Reforming Food in Post-Famine Ireland: Medicine, Science, and Improvement, 1845-1922*, Manchester: Manchester University Press (2014). See also: T.P. O'Neill, 'The scientific investigation of the failure of the potato crop in Ireland 1845–6', *Irish Historical Studies,* 5 (September 1946), pp.123–38

[7] Sarah Easterby-Smith has shown that plant traders in eighteenth-century Europe carried out crucial work to cultivate plants in new soils—see *Cultivating Commerce: Cultures of Botany in Britain and France,* Cambridge: Cambridge University Press, (2018), pp.27-28. On the importance of cultivation methods to the plant sciences, see for instance Helen Anne Curry, 'Imperilled crops and endangered flowers.' In H. Curry, N. Jardine, J. Secord, & E. Spary (Eds.), *Worlds of Natural History*, Cambridge: Cambridge University Press (2018), (pp. 460-475); see also, Helen Anne Curry 'Gene Banks, Seed Libraries, and Vegetable Sanctuaries: The Cultivation and Conservation of Heritage Vegetables in Britain, 1970–1985', *Culture, Agriculture, Food, and Environment*, (forthcoming, 2019)

[8] Courtney Fullilove, *The Profit of the Earth: The Global Seeds of American Agriculture.* Chicago: Chicago University Press (2017), p.84

[9] Staffan Müller-Wille, 'Names and Numbers: "Data" in Classical Natural History, 1758-1859', *Osiris* 32:1 (2017), pp.109-128 , p.128. On the importance of experimentation and observation of growth to natural history during this period, see Mary Terrall, 'Experimental Natural History', in *Worlds of Natural History,* Edited by H. A. Curry , N. Jardine , J. A. Secord , E. C. Spary (Cambridge: Cambridge University Press, 2018), pp.170-185

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