**Introduction**

'Paraquat is the B.S.I. (British Standards Institution) common name of the cation 1,1'-dimethyl-4,4'-bipyridylium, which is available as the dichloride of the di(methyl sulphate).'[[1]](#footnote-2) This is the formal description of the herbicide paraquat, which was characterised, tested and formulated by Plant Protection Limited, a subsidiary of Imperial Chemical Industries (ICI). First synthesised in the nineteenth century and used as a redox indicator dye,[[2]](#footnote-3) the herbicidal potential of the group of chemicals it belongs to, the quaternary bipyridyls, was first observed by ICI in 1947 and work started in earnest on paraquat and diquat weedkillers from 1955. An agricultural paraquat product, Gramoxone W, became available to farmers and horticulturalists in 1962, followed in 1965 by a less concentrated version for amateur gardeners called Weedol. This chapter looks at the development of paraquat as a herbicide, its reception in Britain, and how some users were determined to ignore the categories of use set by the product makers.

The bipyridyl herbicides, paraquat and diquat, are known as contact herbicides, meaning that they kill plants by being absorbed through leaves. They are rapidly inactivated by the soil, which initially dampened the enthusiasm raised by their unusual herbicidal strength. They are also unselective, killing all plants. These three qualities hailed the bipyridyls as different from other available herbicides. Recently developed weedkillers on the market such as Fison's simazine were selective, killing broadleaved plants, and were used to suppress weed growth by remaining active in the soil for months. Researchers at Plant Protection had developed MCPA (2-methyl-4-chlorophonoxy acetic acid) which persisted in the soil and was taken up through the roots and then disrupting the growth hormones of the plant. This selectively killed broadleaved plants, meaning that grass-like crop plants such as wheat were unaffected. A 1958 market survey presumably of agricultural users, indicated that there was a strong demand for similar, even more selective, hormone weedkiller.[[3]](#footnote-4)

If ICI had prioritised this revealed demand for similar, more narrowly selective weedkillers, they would not have developed paraquat as a herbicide, which was neither of these things. Carrying out market surveys to guide product development can be helpful, but companies are also very effective at creating and promoting new uses that their customers had not considered.[[4]](#footnote-5) As ICI were in tune with the problems that growers faced in agriculture they could create effective solutions that were ultimately embraced by users who identified that this product had been developed with their situation in mind.

One person in particular has been identified as weaving together the problem scenarios and the particular qualities of paraquat. Chemist William (Bill) Boon viewed inactivation by soil as a useful property and persuaded his reluctant colleagues that paraquat was worth developing as part of a completely new method of farming. Bradbury *et al* identified Boon as the ‘product champion’ using Schon's dissection of successful innovation.[[5]](#footnote-6) Schon described the champion as ‘willing to put himself on the line for an idea of doubtful success... he is capable of using any and every means of informal sales and pressure in order to succeed’. Without a champion, the idea would fail as the person in this role works to overcome resistance within the organisation and allow the concept to be developed into a viable product.[[6]](#footnote-7) As champion for the bipyridyl herbicides, previously involved in successful development of manufacturing processes for mepacrine (an antimalarial drug) and penicillin, eventually appointed head of research at PPL, medal winner and Fellow of the Royal Society, Boon emerges as the only visible researcher in the stories of paraquat written into company histories,[[7]](#footnote-8) and even in accounts written by members of ICI his name dominates.[[8]](#footnote-9) Boon retired from ICI in 1973, and apart from the material Kennedy presents from her interview with the scientist,[[9]](#footnote-10) little can be gleaned about his thoughts on paraquat after it left the laboratory bench. This is a shame, because once in the hands of users paraquat gained a reputation as a ‘killer chemical’[[10]](#footnote-11) and the tension that resulted from the desire to protect people from harm, yet keep an extremely effective herbicide available for use is the central story of this chapter.

**Company history**

In order to understand paraquat's development, several divisions of ICI need to be introduced. Reader and Kennedy have written extensively on the general company history and I will draw on their work in this much briefer sketch. ICI entered agrochemistry through nitrogenous fertilisers, which were produced at their Billingham plant. Ammonium nitrate was certainly not in short supply, nationally or globally, and in 1927 as part of efforts to shift their products, ICI bought a farm, Jealott's Hill, near Maidenhead which they set up as a propaganda centre. Jealott's Hill was a combined research, development and showcase site, where they would test products, develop routines of grassland fertiliser application for pasture maintenance, as well as act as an educational and inspirational hub for their salesmen, known as 'agricultural advisors'. They made efforts for this research centre to be respected by government research farms, like Rothampstead, and to be taken seriously rather than simply a promotional vehicle for ICI products. This was part of a successful, long term plan to sell direct to the users of their chemicals, farmers, rather than go through corn merchants, whom ICI could not rely upon to always promote their products above others.[[11]](#footnote-12) This attention to users is perhaps surprising for a chemical company who were used to dealing with cartels and bulk sales to industry, rather than consumer products, but positioning themselves in this way gave them access to and understanding of a variety of farm practices that would lead to the development of products that addressed specific problems and needs of farmers. By demonstrating the practical use and real results their agricultural advisors could generate a demand for ICI's reliable, high quality products.

Grass feeding and silage were areas that ICI had been very active in since the 1930s, when they were building up their fertiliser sales, and developing a network to sell direct to farmers. ICI worked out methods using caustic soda (manufactured by ICI) to break down straw, creating a starchy feed that could supplement a diet of dried grass for cattle. The company also cultivated contacts in government, which enhanced the visibility of their research and lobbied the Ministry of Agriculture to promote their progressive, intensive methods (dependent on ICI chemicals) to farmers more widely.[[12]](#footnote-13)

In 1937, ICI joined forces with Cooper McDougal and Robinson, a chemical company who had expertise in crop protection, that is to say pesticides and herbicides. This complemented ICI's crop production business and gave more scope for the chemicals synthesised in their research groups to be applied. The joint venture was an attempt to prevent intellectual and sales territories being encroached and allow networks of contacts to be taken advantage of. The resulting subsidiary company was called Plant Protection Limited and was based at ICI's farm Jealott's Hill. This means that when intense work started on the ammonium quaternary salts that would yield paraquat and the closely related diquat, Plant Protection Limited was jointly owned by ICI and Cooper McDougal and Robinson but changes would take place before any products reached the market.[[13]](#footnote-14)

The other divisions that should be introduced before going further are ICI's Dyestuffs, and General Chemicals, respectively based in Blackley in Lancashire and at Runcorn in Cheshire. Dyestuffs was ICI's main organic chemistry section, where new chemicals were synthesised. This was a dynamic research division, with a high proportion of its members fresh out of university, enthusiastic, creative and skilled in modern chemical techniques, who were under the guidance, and at times, protection, of an experienced and market savvy management.[[14]](#footnote-15) When newly synthesised chemicals were screened, if they showed pesticidal activity they were sent for field testing and development at the Plant Protection facilities. The geographic separation of chemists from the biologists and agriculturalists no doubt slowed exchanges and in 1954 a team of five chemists, including William Boon, moved south to be permanently based at Jealott's Hill.[[15]](#footnote-16) This was not the only movement of chemists from the Dyestuffs group; at about this same time the Pharmaceutical Division were preparing to fledge having been set up within the group in 1944. It had been gaining strength, but remained under the control of Dyestuffs until 1957 when it moved to the newly created Alderley Park site.[[16]](#footnote-17) Perhaps all the preparations for change in the company, as well as the geographic distance between synthetic chemists and farm testing, contributed to the delay between the discovery of herbicidal action, and the development of commercial products.

***Introduce*** General Chemicals, or Mond division ***so that when they are mentioned later re. Bradbury it makes more sense.***

**Development of paraquat**

In paraquat's properties Boon saw the potential for, and with the teams of researchers at Plant Protection developed not just a herbicide, but completely new systems of arable farming and pasture regeneration.[[17]](#footnote-18) Doubtless Boon was an extremely clever individual, who unquestionably made important contributions to a wide range of chemical applications but these new systems did not spring from nowhere. The generation of a totally new farming method makes more sense when considered in terms of the company milieux; in a company environment that had a strong practical and political base in agricultural chemicals, where test farms provided data and specialist consultants were available to discuss existing practices and perceived needs.

Boon thought a herbicide that left a mulch of dead vegetation on the surface could help retain moisture and protect the soil from wind, both would prevent soil erosion.[[18]](#footnote-19) Soil erosion might not have been of concern to many British farmers, but ICI were a global company and accordingly paid attention to articulating the benefits could help enhance sales in areas where farmers did face this problem.[[19]](#footnote-20) The potential to avoid or reduce ploughingwas the concept behind ICI's promises that paraquat would revolutionise farming, although the chemical plough idea only started to be fully tested from 1962, the year it became generally available to agriculturalists and horticulturalists. These new methods of using a weedkiller were not fully articulated or tested when Gramoxone was launched, but this extra layer of value or uses beyond just very effective weed control was a promise that ICI proclaimed from paraquat’s launch.[[20]](#footnote-21) In this way, these early agricultural users were experimental users, as the best methods of using the chemical were worked out in different farming scenarios. Researchers, engineers and farmers spent the following eight years developing machinery to allow seeds to be planted with minimal ploughing.[[21]](#footnote-22) Killing the greenery chemically, as opposed to upending the plants with a plough, was followed by mechanically putting the seeds directly into the ground (rather than ploughing again and planting into the furrow), became known as direct drilling.

In 1959, the year that the first 50lb batch of paraquat was made, it was clear that the crop protection business was losing money, so became the subject of a restructure. Plant Protection became wholly owned by ICI, who had been taking the largest burden of subsidising the business. Redundancies followed, though Jealott's Hill also felt the effect, resulting in a certain amount of bitterness and disruption.[[22]](#footnote-23)

That commercial paraquat products reached the market as fast as they did in 1962 shows the commitment of those involved to overcome this transitionary and potentially disruptive period, though stemming the drain of money and generating income must have been strong motivators. That first 50lb batch cost £50 000 and for the development of the herbicide to go ahead, a much more economic method had to be found.[[23]](#footnote-24) Bradbury describes Plant Protection as able to call directly on Mond for help to make paraquat, although he does not say why they did not do this for diquat, which although no-one at PPL could formally direct research to be carried out elsewhere, diquat was apparently such a beguiling chemical problems that the project was researched at multiple international ICI locations.[[24]](#footnote-25) Paraquat was different as researchers and engineers at one organisation and location, Mond, built a pioneer plant in 1961 and crudely produced enough paraquat for field testing. New, more efficient pathways and processes were worked out there for a second plant in1962 and a third generation plant in 1968 (?), with FR Bradbury, CW Suckling and MB Green being mentioned as important in paraquat's commercial development.[[25]](#footnote-26)The financially viable process was also “so complex that it assured a virtual monopoly of manufacture”.[[26]](#footnote-27)

The timeline of paraquat development (Table 1) shows that it was very early on in trials that the company started to widely promote paraquat as Gramoxone, with promotional stories appearing in agricultural news from August 1962,[[27]](#footnote-28) and that even Weedol was on the market in 1965 before an efficient manufacturing method was fully in their grasp. They must have been very confident that there was enough demand for their products, or that they could generate the demand, to go ahead product with development and to continue investing in improving the manufacturing process. Publicly staking out the potential for the herbicide in this way would also help to establish ICI's priority and corner the market for any similar products from would-be competitors.

Despite hyperbolic stories in the press (no doubt triggered by a similarly worded ICI press release) about farms being deserted thanks to the chemical plough,[[28]](#footnote-29) the direct drilling method was slow to be adopted, possibly because of the need for new expensive (and not fully reliable) equipment that could plant seed directly into the ground.[[29]](#footnote-30) It could also point to a mismatch between the needs ICI perceived and the actual needs of the majority of farmers. This ambitious revolution depended on equipment which most farmers did not have, and would not be persuaded to buy or hire while the results were not guaranteed. The oil crisis of 1973 and related recession gave ICI an unexpected angle for promoting direct drilling when they calculated that it could reduce fuel used by farmers.[[30]](#footnote-31)

| **Date** | **Regulation/context** | **ICI Activity** | **Paraquat Event** |
| --- | --- | --- | --- |
| 1883 |  |  | Paraquat first synthesised, used as redox indicator (not ICI) |
| 1927 |  | ICI bought Jealott's Hill farm, set up propaganda unit |  |
| 1933 | Pharmacy and Poisons Act, est of Poisons Board |  |  |
| 1937 |  | Formed Plant Protection Limited with Cooper McDougal and Robinson |  |
| 1947 |  | Fernhurst bought as new PPL site | Herbicidal activity discovered at ICI |
| 1952 | Agriculture (poisonous substances) Act |  |  |
| 1954 |  |  | Boon and others moved from Dyestuffs at Blackley to Jealott's Hill |
| 1956 | Agriculture (Safety, Health and Welfare Provisions) Act |  |  |
| 1957 | Pesticides Safety Precautionary Scheme; Consumers Association (Assocn for Consumer Research Ltd) | Alderley Park opens and Pharmaceutical Division moves there, independent |  |
| 1959 |  | PPL losing money, became wholly owned by ICI, restructure of PPL |  |
| 1961 |  |  | Paraquat pioneer production plant |
| 1962 | Silent Spring published |  | Second production plant for paraquat, Gramoxone enters agricultural market |
| 1965 | Chemicals for the Gardener v2 |  | Weedol enters domestic market |
| 1966 |  |  | First paraquat related deaths recorded |
| 1967 | Farm and Garden Chemicals Act passed (not in force until 1973) |  | PPL gains Queens Award for export activities, mainly due to paraquat |
| 1968 |  |  | Improved production plant, 1st paraquat deaths reported in mainstream media, added to Poisons List |
| 1972 | Poisons Act, Poisons Board cont. |  |  |
| 1973 | oil crisis; Economic recession until 1975 |  | Patent expires, but ICI remain only producer in UK |
| 1974 | Health and Safety at Work Act; Health and Safety Commission established |  | Stricter rules for poisons sales, Stenching agent added to Gramoxone |
| 1975 |  |  | Weedol formula changed to include diquat, reducing the paraquat content. |
| 1981 | Wildlife and Countryside Act |  |  |
| 1986 | HSE enforces pesticide safety |  |  |

Table 1: Timeline of relevant company activities and key events in paraquat's development

**Protecting Users**

Before any products reached the market, PPL's first line of protection for the users of all their paraquat products was that they tested the chemicals and voluntarily subjected the herbicides to the scrutiny of a variety of governmental regulatory boards (see the Contextual chapter for more detail on the formation of regulatory bodies). The second line of protection were the instructions that they provided to users on the packaging, which were also vetted by the experts committees of the regulatory bodies. Once the products were on the market, the company and regulatory boards monitored reports through doctors and hospitals of incidents involving the chemicals. Retailers were also considered a layer of protection, who were meant to ensure that agricultural preparations were not sold to domestic users. The influence of regulatory boards on formulation and labelling before the product even came onto market will be discussed, followed by examining the role of retailers.

Decisions about the formulation

Gramoxone had a concentration of paraquat at 20%. The herbicide arrived with agricultural or large scale users, as a brown liquid which they diluted in their spraying equipment. PPL had decided that to offer home gardeners this weedkiller, and to diversify their market, they should provide a weaker product in order that the risks involved in storing a strong concentrate in the domestic environment were avoided. The name Weedol had been settled on early in the process, despite the similarity of this descriptive brand name to Fison's long acting, total weedkiller based on simazine which had been on the market since 1959, Weedex.[[31]](#footnote-32)

A reason for the different concentrations was that paraquat is very corrosive. Plant Protection sold Gramoxone in glass or polythene bottles that could withstand containing such a chemical.[[32]](#footnote-33) The Advisory Committee on Poisonous Substances Used in Agriculture and Food Storage (involved in the regulation of new chemicals entering the UK market, as discussed in the Contextual Chapter) were content that this corrosiveness would not be a serious problem for agricultural users. They were expected to follow the instructions to immediately wash off splashes of concentrate, and to avoid prolonged contact with the dilute solution.[[33]](#footnote-34)

As well as effects on skin, ICI made observations on test animals to find out what happened when paraquat was ingested. This test was relevant whether the product was presented as a liquid or solid, and applicable to industry workers making the product, as well as agricultural or domestic users applying it. LD50 tests on rats were presented by PPL in 1962, which appeared to show no effect when eaten in small doses, but did kill when eaten in large amounts.[[34]](#footnote-35) Over time these laboratory tests were supplemented with observations from real scenarios or investigations triggered by real world questions, such as the length of time vegetation should be left before animals could eat it. Disruption of finger nail growth and nosebleeds in ICI staff formulating and packing the chemical had also been observed, explained away by improving the use of gloves and better ventilation. A variety of possible mechanisms were discussed by the scientists on the committee and Plant Protection representatives, but why animals died and why ICI workers had been affected in that way was not known.[[35]](#footnote-36) The benefits of the chemical were judged to outweigh the potential problems, problems that could be avoided if sensible precautions were taken by the responsible user. This stage of development is not remarked on by Bradbury, Reader or Kennedy, who focused on the organisational structures and individuals within them.

The causticity of the product was the quality the expert committees focussed on with respect to effects on the users. The mode of action in plants, being the disruption of photosynthesis, was not considered an applicable danger to humans (although as Howard summarises the finer details of this disruption would have implications for the treatment for ingested paraquat[[36]](#footnote-37)). The cytological examinations and the oedema which was observed in their test animals did not suggest any particularly unusual mode of death. As far as anybody from ICI or the expert committees knew, paraquat was a skin irritant and it could be poisonous, but that until chemical had been used in scenarios, with real and unpredictable users, they could not know for sure what all the effects on people could be.

Initially, the concentration was to be the only difference between the agricultural and domestic products, with ICI planning on domestication through reducing the size of bottles. The weedkiller was planned to be a mixture of diquat and paraquat making it more similar to their agricultural offering Preglone. The expert committee were apprehensive about PPL's plans for a less concentrated liquid formulation for home use, concerned that these users would not be as experienced with handling chemicals and could be harmed by the corrosive substance. Their user was imagined to be naïve with respect to handling chemicals, as they did not appear to consider what other experience users might have handling diverse chemicals in their daily lives, either at home or at work.

ICI had anticipated a diversity of materials used in domestic watering cans and sprayers, and incorporated an anticorrosive into the mixture, for the safety of the equipment and reliable application of their herbicide. To the subcommittee, this additive indicated that the preparation was corrosive enough to harm users. Minutes from a 1962 committee meeting record apprehension about ICI’s proposals for Weedol, at that point a liquid mixture of diquat and paraquat: ‘Dr Barnes said that he was not happy about this mixture being made available to amateur gardeners’ and ‘Dr Ladell said that the more that was known of these two compounds, the more unpleasant they appeared to be. He would hate to see Weedol in the ordinary garden shed’.[[37]](#footnote-38) They refused to give Weedol clearance until there was more detailed toxicological information and directed the company to look at alternative preparations that would avoid handling and potentially splashing or spilling corrosive liquids, so PPL continued work on developing a solid, granular version of paraquat without diquat that domestic users could dissolve and apply safely.

The result was pre-weighed sachets of solid pellets containing 5% paraquat that were dissolved directly in a watering can or sprayer. In this way, domestic users did not have to handle the product to measure it out, it was less likely to splash about, and there should not be any left over granules or liquid to store. This system of delivery satisfied the expert committees and in 1964 Weedol was given provisional commercial clearance, joining Gramoxone in this state of availability. ICI and PPL were in regular contact with the ministries and expert committees while they monitored the use of their herbicides. That user experience should be investigated was explicitly requested by the Scientific Subcommittee on Poisons Substances Used in Agriculture and Food Storage, who were in charge of examining, approving and monitoring new chemicals used in the situations listed in the title of the group.[[38]](#footnote-39) ICI and members of the committee collected information about all kinds of accidents, so that sales restrictions and printed warnings on labels affixed to packaging could be evaluated and amended if necessary.

Labelling

Labelling provides the user with information about how to effectively and safely use the product. Clear and effective labelling should ensure satisfactory outcomes, because the weedkiller will be made up and applied in the correct way to kill the unwanted plants. A satisfied user will buy the product again. Likewise, someone who has insufficient information to avoid getting skin or fingernail irritation may avoid the product in future, even if they achieved the weedkill they were aiming to. Labelling can reduce the likelihood of accidents, although words on a label or box cannot compel the user to follow them. This was an issue that those in the chemical industry grappled with for every new product. As the director of Fisons expressed on television in 1964, misuse was an ‘inevitable risk’ for any new chemical product. He made it clear that chemists were exceedingly careful to produce useful, effective products that could be used safely, and followed this by directing attention to the user as the cause of any problems, rather than the chemical by saying 'I bet my bottom dollar that someone is going to misuse it so much that even the safest chemical is going to cause trouble somewhere, sometime.'[[39]](#footnote-40)

Awareness of accidental and deliberate poisoning with other weedkillers and more diverse chemicals may have led to the instruction not to repack Gramoxone in an attempt to avoid their product being involved in a tragic event. Alternatively, it may have been concern about an inappropriate choice of vessel in which to store the caustic chemical or a combination of both. However, this instruction is as far as ICI went. In the material presented to the Scientific Subcommittee who awarded approval, there is no indication that any treatments for poisoning were researched, and there was no requirement for this to happen. The user was expected to be a reasonable person who would read and follow instructions. The only advice ICI could give in case of “gross contamination” was to provide generic first aid.[[40]](#footnote-41)

Although this regulatory activity was 'behind the scenes', it was partly communicated to users. In early adverts for Weedol, the 'Approved by the Agricultural Chemicals Approval Scheme' logo is clearly displayed, either visible on any packaging or integrated into the advert body.[[41]](#footnote-42) This logo had been promoted heavily through the MAFF *Chemicals for the Gardener* booklet, which had been published to guide home gardeners to choose products that had been tested and shown effective. The booklet also took care to emphasise the importance of following the safety instructions given by the manufacturer on the label, because these too had been approved.[[42]](#footnote-43) Some of the processes behind approval and what could be expected of products with the Approved logo was also explained by the Consumers Association.[[43]](#footnote-44)

Retailers

When Gramoxone first came onto the market in 1962, it was available to agricultural users from Plant Protection advisors or through agricultural merchants. At this time, retailers were expected to stick to an agreement with ICI about who they could sell the products to. Gramoxone was not bound by any legislative restrictions on selling poisons (see Contextual Chapter), but ICI only intended that it should be made available to bonafide agricultural and horticultural users. The minimum size and therefore cost was such that small-scale domestic users would be deterred. Retailers were instructed to adhere to the same instruction given to users to never repack or decant Gramoxone into other, unlabelled containers. Retailers were placed in a position of policing the boundary between agricultural use and domestic use. Many agricultural merchants would have known their regular customers from past orders but knowing each buyer personally in every instance, to establish whether they had a bonefide reason to purchase Gramoxone was unfeasible.

Weedol was promoted to domestic users from 1965, and it was available from garden nurseries and home improvement centres,[[44]](#footnote-45) chemists including Boots[[45]](#footnote-46) and Timothy Whites,[[46]](#footnote-47) as well as general stores like Woolworths.[[47]](#footnote-48) Weedol adverts suggested simply going to 'your shop'[[48]](#footnote-49), rather than guess the specific outlet that users might prefer to get this type of chemical.

**Imagined users**

By examining the users featured in adverts for paraquat products, images of an idealised user as approved by the company can be constructed. Basing a category of users on those depicted in adverts, remembering that they have been mediated through the press department and an advertising agency, might seem spurious, but adverts have been shrewdly created to appeal to a segment of consumers. ICI did not have to rely entirely on their imagination as they had carried out market research, so those users might have been able to identify themselves or similar concerns in those portrayals. An additional resource that provides a glimpse of some of the ways that users were imagined are the minutes from meetings of the Poisonous Substances scientific sub-committee, where the user was considered.

Minutes

The development of a completely different paraquat formulation, Weedol, for use at home, at a quarter of the strength of the agricultural product, demonstrates that the company accepted that the chemical was too dangerous for a domestic environment. Domestic users were imagined to be unused to handling agrochemicals, which is probably correct, and therefore at risk from diluting a concentrated liquid,[[49]](#footnote-50) which is questionable. Domestic users’ experience with other concentrated household chemicals such as bleach, ammonia or caustic soda does not seem to have been considered, and in this lack of imagination, agrochemicals are defined as different and inherently more dangerous. It is interesting that this distinction is made, and made without question.

The concern about diquat in early Weedol formulations,[[50]](#footnote-51) while it remained in agricultural preparations also caused concern, again demonstrates an imagined difference between the ability of farm and domestic users to treat the products with appropriate care. In the 1970s, diquat was incorporated into a new improved version of Weedol, the fears of cataract apparently solved, forgotten or replaced by fear of paraqyat. This change was not heralded in gardening columns or newspaper articles, but it was announced through the packaging which proclaimed the new formula, and advertisement of the product which showed the packet emblazoned with the declaration of newness.[[51]](#footnote-52) The reason for the change was to improve the weedkilling efficacy but also further reduced the concentration of paraquat while maintaining the efficacy of weedkiller by substituting it for the more easily eliminated and thus potentially less poisonous diquat, was not discussed where users might have read it.

Advertisements

ICI had imagined the user of Gramoxone to be an arable farmer or agricultural worker. Gramoxone was not intended for use by the general public, so it might be expected that adverts for this agricultural product would not to be placed outside specialist publications. The Times carried detailed case study type adverts for Gramoxone in their regular farming supplements in 1963[[52]](#footnote-53) and 1964.[[53]](#footnote-54) This can be interpreted as evidence that Plant Protection and ICI viewed The Times as enabling them to present their products, and associated practices, to farmers or decision makers who were known to be amongst the readers as they would not pay for their advert to be placed somewhere they didn’t think it would pay off for them. Perhaps advertising here was even a good investment to publicly show ICI shareholders what they were doing. The adverts for this product show their ideal agricultural user: a male farmer or farm manager, willing to try new things, taking advantage of fresh agricultural grants, maximising his yields and profits. The farmers and farm managers pictured in these adverts are male, although there are letters in the MAFF folders from farmers who were women, admittedly they appear because they were concerned about an aspect of its use.

The first Weedol advert in 1965 did not portray a user, only a scenario featuring weeds around a rose bush.[[54]](#footnote-55) The following season’s advert showed small illustrations of isolated parts of a user: hands, legs and feet, which although did not show a face, look decidedly masculine.[[55]](#footnote-56) In 1967 photographs of users, rather than application equipment, were used for the first time, but again did not show the whole person. Instead, they showed an excited young girl pointing to the lower half of a man, declaring 'My dad’s a Weedol weeder'.[[56]](#footnote-57) By saving time weeding, perhaps the father could spend more time entertaining the child. The use of the weedkiller in close proximity to the child also visually represents safety, although instructions on the packaging always exhorted the user to keep out of reach of children. This advert appeared in the Daily Mirror and Daily Express, but not the Daily Mail or the Times. In 1967 another advert ran simultaneously, appearing in all the aforementioned papers, which did not show any user figures at all. 'Don’t waste time with weeds – water them away with Weedol'[[57]](#footnote-58) gave potential users a clear and alliterative message about what the product was for, the benefit of saved time and how to use the weedkiller.

ICI's 1968 'Stand up to weeds!' advert was first placed in mid-April, again only showing the lower half of a male user in neat trousers and a shirt, using a watering can to apply weedkiller, standing nonchalantly with a hand on his hip.[[58]](#footnote-59) The wording implies both the physical action of weeding, which with Weedol no longer involves bending or kneeling, as well as overcoming the relentless invasion of weeds in ones' garden. Weedol was also advertised through stores such as Timothy White, as part of multi product promotions, which presented a view of the packaging along with other related products that were part of the seasonal discount offered.

In 1970, a whole user is depicted for the first time, and compared to a non-user.[[59]](#footnote-60) The user is a middle aged man, probably in his own garden, where he is using it among flowers and shrubs, not to clear expanses of weeds in an industrialised setting. He gives the impression of being at leisure, through his casual clothes, his relaxed, upright stance and smoking a pipe. The dress and actions of the gardener using Weedol in these adverts communicate how easy and clean using the product is. If Weedol was not available, meaning they had to manually weed instead, they would have to wear clothes that could get grass stains and mud on them, so the pale cable knit jumper, the white shirt cuffs show how mess is avoided. The presence of the pipe is a symbol of leisure, but also of safety. If the user had to weigh out the chemical, they risked getting it on their hands then transferring it to the pipe and from there into their mouths. Dissolving Weedol directly in a watering can or spray cannister avoids this contamination problem. Perhaps these men would have been less used to handling potentially dangerous chemicals in the home, leaving that task to their wives. Perhaps the comfort of home, and a mindset unique to leisurely activities, meant that vigilance and care that men might have applied to handling dangerous substances in their working lives was abandoned once in the domestic environment. This is partly brought about by the assumption that if something was dangerous, it wouldn’t be available, “they” wouldn’t allow anything bad to happen to a customer/consumer.

Competition for resources (soil nutrients, water, light) is a major reason for weeding, not just that weeds can look untidy. Competition for water in times of drought was especially important and in 1976 the UK experienced the hottest and driest summer in 350 years. However, ICI did not create a new campaign capitalising on this, and instead continued to run 'Don't waste time with weeds'. Space was also a resource that was competed for and 'Stop weeds going to bed with your flowers'[[60]](#footnote-61) places the gardener in a protective role against the invasion of weeds into the flower bed. The scenario played out is of a beautifully cultivated flower bed, often considered a feminine garden activity, although the advert does not convey any indication of who the user might be though its use of gender neutral language.

Advert frequency

The dates that Weedol and ICI in the garden multi-product adverts were placed, typically April to July indicate the seasonality of Weedol application. It can also be seen in these adverts how ICI publicised diversification or extension of Weedol applications, when adverts for Weedol start to appear in the autumn, which had previously not been considered a time to apply Weedol.[[61]](#footnote-62)

*Figure 1: Graph showing frequency of adverts mentioning paraquat products in the Times and Daily Mail newspapers*

Figure 1 demonstrates differences in the frequency of advert between two newspapers, The Times and the Daily Mail. The Times carried more adverts for Gramoxone than it did for Weedol. The Mail carried adverts for Weedol much more frequently than The Times. The advert that the Times carried for Weedol in 1967 was 'Don't waste time with weeds' which was the least verbose or informative among the early Weedol adverts. The Times had a very small readership compared to the Mail, so for ICI more potential users could be reached by spending money advertising domestic products in the Mail. They did not neglect potential users who also read the Times, but here they presented much less information-dense and therefore less persuasive adverts, which still brought the existence of Weedol to the attention of the reader. The richly detailed adverts that were placed in the Mail and other papers were designed to win over potential users by spelling out all the potential benefits in all the different scenarios. These readers were also treated to the greatest variety of Weedol adverts. It may have been that this demographic may have needed more convincing to part with cash for a job that could be done for free, although it took time. The focus on time saving and costs of material suggests that ICI knew that these were important to the bulk of their users, which may also relate to the very informative adverts placed in these middle to lower class newspapers.

Summary of adverts

The campaigns are summarised and tabulated in Table 2, in order to gather together the key words that were used in the adverts and to see changes over time. Early Weedol adverts were verbose and very informative, designed to explain to potential users the scenarios that Weedol could be deployed and what users could expect from it. Great pains were taken to put across the ease and simplicity of use, emphasising the use of the plants' own 'natural' processes to kill the plant. Other than 'kill' which was necessary to convey the effect on weeds, one of the most frequently used words was 'harmless'. The soil would not be harmed, non-target plants would not be harmed, but other users of the garden such as pets, wildlife and people are rarely mentioned.

ICI's adverts imagined their users to be looking for particular assurances from the product, and the adverts consistently addressed these by highlighting the “harmlessness” to anything other than weeds, time saved,[[62]](#footnote-63) reduction of effort by switching “hard”[[63]](#footnote-64) or “back-breaking”[[64]](#footnote-65) work for faster and easier watering. An awareness that Weedol was perceived by users to be expensive also shows in the adverts. They detail the precise area that can be treated,[[65]](#footnote-66) and consistently highlight the low costs involved, either of the product itself or of the specialised applicators that would allow the herbicide's most economical application.[[66]](#footnote-67)

Where a user is pictured, ICI's idealised user is adult, and male. Although the rhetoric of weeding can be war-like, invoking battles, domination and death, the language of Weedol adverts was restrained in this sense and instead focused on saving time and effort, which is applicable to both men and women. Readers of any gender are included in the advert through the consistent use of the direct address 'you'. The most common image that the user can relate to in the advert, is that of the packaging which they can go on to find in their shop.

However, by not featuring a woman applying the product, the overall balance of is tipped towards addressing men as the principle likely users of their product. In the search for Weedol adverts, I found one for Spring Spray[[67]](#footnote-68) on the same page as Weedol which showed a woman applying pesticide spray, although it was framed as 'spring cleaning in the garden'. Again, when considering other garden equipment, such as lawnmowers, women were often pictured using them essentially to communicate the ease with which it could be used.[[68]](#footnote-69) Was this a result of their market research, that men were interested in a chemical solution to this task? Are women less inclined to use weedkillers? Are women supposed to be nurturing rather than killing? Maybe this will come through in oral history work or more archival research.

Paraquat is not hidden as an ingredient, it is positively promoted as the reason to buy and use the product, however, there is no mention of the percentage of active ingredient. By not distinguishing the differences clearly in the advertisements or the packaging, ICI facilitated users making a hazy distinction between the agricultural and domestic versions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | **Advert** | **Paper** | **User image** | **Key phrases** |
| 1965 | Ends the work of weeding | Express, Mirror | No user | Hard work, neutralised, harmless |
| 1966 | End the work of weeding | Express, Mirror, Mail | Hands, feet | Safely, harmless, easier, endless, economical, accurate |
| 1967 | Don't waste time with weeds | Times, Express, Mirror, Mail | No user | Time, revolutionary, safely, save hours |
| 1967 | My Dad's a Weedol weeder | Express, Mirror | Father (plus daughter) | Saves hours, kills, harmless |
| 1968 | Stand up to weeds | Mirror, Mail | Male | Gardeners, revolutionary, kills harmless |
| 1969 | Block the living daylight out of weeds | Express, Mirror, Mail | No user | Low priced, harmless, unique, rain, time saved |
| 1969 | Great summer offer |  | No user |  |
| 1970 | ...in the garden with ICI | Mail, Express, Mirror | No user, but male tech advisor | Save hours of back breaking |
| 1970 | … without killing the soil or your back | Mail, Express, Mirror | Gloved hand | Backache, harmless, economical, ordinary, cost |
| 1971 | Two ways | Mail, Express, Mirror | Male | Back-breaking, minutes, kill, harmless, cost |
| 1975 | … without killing the soil or your back | Mail, Express, Mirror | Male | Kill, safely, inactivated, economical, hours, back-breaking |
| 1977 | Fast and easy. | Mail, Express | Percy Thrower | Safely, backache |
| 1977 | ...plenty of help | Mail, Express | Percy Thrower | Compete, safely |
| 1978 | Stop weeds going to bed with your flowers | Mail | You | Easy, kill, rain, effective |
| 1979 | Our weeders choice/ Weedol about it | Express, Mail | You | Kill, revolutionised, hours |
| 1980 | Don't let weeds be the first sign of spring | Times | You | Effective, speedy, inactivate |
| 1981 | The British gardener's No.1 weedkiller | Mail | You | Kill, harm, inactivated, risk, rain, gardeners |
| 1984 | Weeds stop here | Mail | No user | Inexpensive, Care |

Table 2: Table showing the Weedol advertising campaign key words

**Experimental Users**

Plant Protection and ICI did not just imagine users, or base expectations purely on market research. They were able to test their products in real scenarios, either on company experimental sites, or with recruited farmers and domestic gardeners. As mentioned previously, ICI marketed Gramoxone, direct drilling and pasture regeneration before the techniques had been fully worked out and tested. The idealised users that were presented in their adverts discussed in the 'imagined users' section were their experimental users, willing test subjects providing useful information on user experience.

ICI were also able to use their own employees as experimental domestic users, performing a type of acceptability test before the product was launched commercially. The real life scenarios that occurred with users who the company could hope to rely on to follow instructions and handle chemicals carefully, coming as they did from the chemical industry. When Weedol was sent out with Plant Protection staff for testing at home, key questions were how well and how easily the granule dissolve, how and when the weedkiller was applied and what kill rate was achieved. Some experimental users found the granules made a foamy solution, or that the solution was so cloudy they could not tell if the granules dissolved. Some found a sediment at the bottom of their watering can, which could not be dissolved further. Although the solution did not block watering can roses or sprinkle bars, this sediment could indicate waste to some users, especially the cost-conscious ones, and probably drove the inclusion of a helpful tip in the instructions to use warm water but not boiling water to help the granules dissolve more completely. Comments about the practical experience with the packaging also helped ICI improve the safety and efficacy of the product, as by following suggestions from their experimental users the design could be altered to avoid accidental spillage and wastage when the containers were opened. These experimental users also caused questions about the size of commonly owned watering cans, and thus what could reasonably be expected to give reliable results if a single use sachet was used.[[69]](#footnote-70)

These experimental users also gave ICI reaffirmed which types of weed users commonly wanted to remove from their gardens and indicated what would or would not be killed successfully with Weedol. Reports came back of the docks, nettles and couch grass being particularly resilient, especially when the weeds were above a certain size. Controlled tests had showed that paraquat could kill both broadleaved and grassy plants depending on the dose. The way the report highlights the large size of the weeds suggests that they were keen to make this aspect of weedkilling failure the responsibility of the user in that they should have applied it before the weed got so large.[[70]](#footnote-71) Applying the weedkiller to young or small weeds was the advice given, rather than to avoid using it on certain types of weed.

**Model Users**

Model users are a creation of the publishing and broadcast industries. By cultivating an authoritative gardening character, a respected regular feature (column or programme) can be a guaranteed to interest real and vicarious gardeners alike. They may not agree with the practices, but this can generate lively letters or further content if readers or viewers feel strongly enough to communicate these views. In the following section, the role of 'celebrity gardeners' in setting an example and gaining acceptance for new chemical products is examined further.

Weekly gardening columnists modelled how to correctly use the chemical and broadcast a schedule for using the herbicide. The device of 'jobs to do this week' is well used in their columns, which presents very similar advice and instruction on weeding, planting, fertilising as might be set out in gardening almanacs or books. The newspaper columns give the opportunity to add topical comment on rain or sun, or other events to supplement and fine tune the advice. In part, these model users are also experimental users, being among the first to use the Weedol preparation in real situations. They also disseminated new uses, such as using Weedol on rose suckers.[[71]](#footnote-72) A rose sucker is produced from the rootstock and competes for nutrients with the desired variety grafted onto it, sucking the nutrients away before they can get to the rest of the plant. In this sense of competition for resources, suckers are weede, rose gardeners discovered that applying Weedol was a convenient form of control. Cutting suckers off can result in the formation of even more suckers, if it is pruned at the wrong point, so using Weedol avoided this. Although Weedol is a contact herbicide, it is translocated, so trying this out was something of a gamble for those first users. However, once the model user had tested it out, their evidence could assure the other potential users that this was a reasonable action to take against suckers.

Gardening columns often referred to readers’ letters, and in 1968 readers of *The Times* wanted to know why garden columnist Roy Hay kept casually recommending a potentially lethal chemical to them, without ever mentioning risk.[[72]](#footnote-73) The columnist explained the existence of a domestic product which was much safer, which was entirely true but possibly not did not go far enough. Looking over the columns where the herbicide is invoked, Hay was often unclear or inaccurate: he usually simply said ‘paraquat’ rather than specifying the brand name Weedol, he described the domestic version as ‘smaller packs’ rather than less concentrated, and directed them to follow the manufacturers’ instructions. The model user could also counter accusations that Weedol was expensive, by reiterating that by investing in the appropriate application spray bar, the herbicide could be applied without waste.[[73]](#footnote-74) The model users were by no means perfect, or even ideal, as inconsistent product placement shows, or the occasional modelling of unideal opinions such as that ‘amateur packs were expensive’.[[74]](#footnote-75)

Columnists continued to offer paraquat as an option for home gardeners, even when closer reading of descriptions of their own gardens and practices showed that they chose not to use paraquat in as many situations as they suggested. Some columnists actually preferred to use cover planting to avoid weeding in their own gardens, limiting the amount of bare soil that could be colonised by weeds.[[75]](#footnote-76) Paraquat could play a part in preparing the soil for the desired plants, but it was not the kind of frequent application that ICI had envisaged. However, for many of their readers, this aesthetic was alien and messy. The culture of digging was still strong, with the columnists exhorting an 'either-or' approach: either use weedkiller and do not dig nor hoe, or dig (or hoe) and do not use weedkiller, as disturbing the soil brought more weed seeds to the surface to germinate. Using Weedol while the weed seedlings were tiny would ensure that the resulting dead material would quickly dissolve away. Weedol required a significant change in gardening practice, targeting seedlings rather than visible, graspable weeds. Using the chemical on larger weeds did not give such satisfactory results, leaving a desiccated, dead plant which would then have to be pulled out, inevitably disturbing the soil and encouraging new weed growth.[[76]](#footnote-77)

ICI even featured a model user, Percy Thrower, in some of their adverts.[[77]](#footnote-78) Thrower had been a household name since 1947, when he started giving gardening advice on BBC radio. He also had columns in the Daily Mail and Amateur Gardening, his advice appeared regularly in the Mirror, he published books, as well as being lead presenter on the television show *Gardeners World* and appearing on children's programme Blue Peter. Thrower embraced the range of ready-made chemical aids, but O'Sullivan identified Thrower's enthusiasm for chemical fixes as one of the factors in his parting company with *Gardeners World* in 1976.[[78]](#footnote-79) This decision may have reflected not just the view of the programme makers, but also that of their audience.

This uneasiness towards chemical assistance in the garden was generally not detectable in garden columns, which expected devotees of smooth green lawns and productive gardens to have an arsenal of chemicals to hand to deal with moss, fungi, insect pests, moles and rodents, accelerating the rotting of compost heaps, green weeds and soil fertility issues. However, chemical methods were always given alongside a manual method where applicable, and choices of chemical aids given where appropriate, so that readers were given options and one formulation was not promoted above others. Where the product had unique properties, which Weedol did as it was inactivated by soil, there were not always alternatives.

**Disobedient or Careless Users**

Disobedient users did not follow the instructions crafted to direct safe use. Typically, a disobedient professional user decanted Gramoxone into an unlabelled drinks bottle and allowed it into a domestic environment, or they might not wash off splashes immediately, or soak up a larger spill. A disobedient domestic user of Weedol would allow children access to the granules, dissolve granules to make up a solution concentration different to those recommended by ICI, or use the herbicide for purposes other than killing weeds in their garden.

Howard[[79]](#footnote-80) found that there were plenty of instances of trained, experienced Gramoxone applicators being careless when handling the concentrate and applying the dilute solution,[[80]](#footnote-81) going so far as to declare farmworkers as “notoriously careless”.[[81]](#footnote-82) Injuries to the skin and eyes were caused by this kind of carelessness, but if the result of disobedient use was ingestion, the consequences were often fatal. There were ‘no special symptoms’ of poisoning that ICI could offer to guide generic first aid. If housewives read first aid guides in magazines or household management manuals, they would be familiar with tables that described what the first aider should look for: physical signs such as sleepiness or burning sensations, and material evidence in the form of bottles of medicines or household chemical, then helped them to choose an appropriate action such as encouraging vomiting, or drinking milk, water, coffee. New chemicals need some unfortunate first users before medics can construct meaningful patterns of action to deal with them. Paraquat ingestion was a case in point, as skin or eye irritation was comprehensively covered by the usage instructions to washing off splashes with clean water.

Despite being corrosive, paraquat did not burn immediately and when first marketed, did not necessarily cause vomiting. There were clinical tests, of course unavailable to domestic first aiders, for detecting paraquat in urine or blood, and this method was used to verify and quantify exposure to hospitalised victims of poisoning. These were not routine tests and there were instances where the victim suffered for weeks before this kind of test was run and paraquat poisoning diagnosed or confirmed.

As well as irritating and ulcerating the mouth and throat, paraquat has a peculiar effect on lung tissue in particular, irritating and thickening the membranes that gas exchange occurs across, reducing the efficiency of the organ, but also causing cell proliferation (a repair response) in the lungs which thicken so much that the lungs solidify. Despite doctors’ best efforts to deactivate paraquat with Fullers earth, or kaolin, mimicking the deactivation seen in soils,[[82]](#footnote-83) or to dilute the chemical in the bloodstream through forced diuresis as was employed in treating barbiturate overdoses,[[83]](#footnote-84) their treatments were experimental and often unsuccessful. In some cases, they would even worsen the situation, although this could provide evidence supporting increased understanding of paraquat's mechanism of action.[[84]](#footnote-85) Gramoxone poisonings led to a horrifyingly certain and slow death, potentially over two weeks or more.

When stories of accidental Gramoxone poisonings started to be publicly reported in newspapers in 1968, the stories invariably conveyed the lack of effective treatment available, often with the stock phrase ‘no known antidote’. As Boon wearily noted, this antidote statement was technically accurate, but it was not unusual as in the true sense of antidote where one chemical neutralises another, very few poisons have an antidote, not even aspirin. Boon attributed this phrase to an answer given to a coroner in court to the question whether an antidote was available.[[85]](#footnote-86) However, it grabbed attention and was useful shorthand in newspapers for expressing the horror and despair that was experienced by victims, their families, and the medics who cared for them. Arsenic based weedkillers had been fatally poisoning people for much longer, and correspondingly progression and management of poisoning was better understood and accepted.

Accidental poisoning

Repacking Gramoxone into unlabelled bottles was the principle cause of accidental ingestion, and was also associated with theft from an employer.[[86]](#footnote-87) Crofters and other small scale agricultural users, especially in Ireland, were identified by Plant Protection as a population of users who were particularly prone to buying small amounts of agricultural chemicals in reused containers such as drinks bottles and were accordingly disproportionately accidentally poisoned.[[87]](#footnote-88) Other than pointing out this regional difference, the company did not offer any further comment on retailers or purchasers who broke the condition of sale not to repack.

Workers whose job it was to clear unwanted vegetation - agricultural workers, council workers, people maintaining runways and railways - and, disregarding whether they had permission or not, had no reason to store the herbicide in their own homes. Therefore it must be assumed that they were impressed by its effectiveness and took it home for themselves or friends to use domestically. MAFF described people who brought home Gramoxone from agricultural or horticultural stocks as trying to avoid the expense of buying Weedol.[[88]](#footnote-89) From the circumstances reported in newspapers, liquid paraquat preparations tended to be brought home by quite young men, who worked in agricultural or horticultural jobs or were in social circles with people who could access the high concentration product.[[89]](#footnote-90) Although they might have been impressed by its efficacy, they do not seem to have respected the strength of the chemical and its potential to do harm. ICI could influence this attitude through their choice of words on Gramoxone's labelling.

There was a lot of room for negotiating the wording on labels. This can be seen in a 1967 memo following the earliest accidental poisonings, which all related to repacking, in which Roy Goulding, founder of the National Poisons Information Bureau[[90]](#footnote-91) and member of the Poisons Board, wonders how to prevent this. He wrote 'How we can deter them I don't know, but labelling the concentrate as poison might help.”[[91]](#footnote-92) Plant Protection were resistant to suggestions that the word 'Poison' should be included on the label, as they did not want potential users to be scared by the word “poison” and put off using their product. They maintained that when users followed the instructions, the product was safe.[[92]](#footnote-93) In 1968, they reworded the labels to include 'Dangerous if swallowed', which is not as direct. By 1973, the word 'Poison' appeared prominently on Gramoxone bottles.[[93]](#footnote-94)

No matter what words were employed, the reception of them depended on the user. If they did notice and read the label, this was no guarantee that they would not still take a sample of the chemical for domestic use. As an experienced user, they may well have believed themselves competent to use the same product at home. Where the problem generally lay was in the presence of other people in the domestic environment who could not be expected to know what the liquid was or the warnings that accompanied the herbicide. Once inside an unlabelled, reused bottle, the herbicide could be given another identity by an unsuspecting, unintended user. The familiar shapes of drinks bottles, an important part of their brand identity, sent out the wrong signals about safe contents when they were reused to store agrochemicals. The bottles of concentrated herbicide found their way into bags,[[94]](#footnote-95) glove compartments,[[95]](#footnote-96) sheds,[[96]](#footnote-97) kitchens[[97]](#footnote-98) and even fridges[[98]](#footnote-99) where they were mistaken for dark coloured drinks: cordial,[[99]](#footnote-100) cola,[[100]](#footnote-101) beer,[[101]](#footnote-102) wine,[[102]](#footnote-103) or sherry[[103]](#footnote-104)then swigged by curious or thirsty children, teens and adults, with very serious and sad consequences.

When drunk, paraquat could be quickly absorbed into the blood, with pathologists warning that a mouthful could be lethal even if it was spat out,[[104]](#footnote-105) or speculating that a graze on a child's knee could be an entry point for a fatal dose if they played in a recent sprayed field[[105]](#footnote-106) although calculations by Howard shows that at the dilutions that it should be sprayed, they were not a danger to health.[[106]](#footnote-107) Despite accidental deaths among people of all ages, it was perceived that children were most at risk. A discussion on paraquat in Handyman Which? pointed out that Gramoxone was 'one of the main poisons which kill children under 5 in this country' behind pharmaceuticals.[[107]](#footnote-108) Worded like this, it sounds shocking, but the actual incidence of paraquat poisoning, in fact with any household or garden chemical, was very low, especially compared to the number of instances of poisoning with prescribed and over the counter drugs. The problem lay in the outcome and that pharmaceutical poisonings were more likely to be treated successfully.

Carelessness was not only a problem with professional users. From the product launch in 1965 to May 1967, 7 million units of Weedol were sold. Considering the volume sold, the five reported medical incidents involving Weedol which could be attributed to carelessness is a tribute to how safe the granulated product could be. A child “who should not have access to the preparation” ate the granules, demonstrating the carelessness of the adult in charge to not carefully put the product out of reach of children, and in addition there were four instances of skin irritation which arose “during application of the chemical and resulted from carelessness”.[[108]](#footnote-109)

Self harm and suicide

Another form of disobedience was to go against the instruction that it was only to be used as a herbicide. An example of this was using the product as an insecticide[[109]](#footnote-110) but another was using the chemical to deliberately harm oneself or another person. This disobeyed the advice that paraquat was 'not to be taken' in addition to 'use only as a herbicide', and it occurred with Gramoxone and Weedol.

In one of the early suicides recorded while Gramoxone was on provisional clearance, ICI wrote that the Scottish man had also drunk whisky.[[110]](#footnote-111) The inclusion of these details seems to be to highlight the human factors that are beyond ICI's control. Three suicides had been attempted using Weedol in the period it was under especially close scrutiny from the Pesticides board, between 1965 and 1967 so this was before fatalities relating to Gramoxone had been widely reported.[[111]](#footnote-112) The first public report of a suicide, although not in mainstream UK newspapers, was in September 1967 when a case study of an 'unusual' suicide by injection of Gramoxone, which took place in Israel was presented in the British Medial Journal.[[112]](#footnote-113) It was much more usual for people to drink the herbicide.

Paraquat was not a special case among weedkillers, as suicide using this type of product was already an established practice. Michael Clarke pointed out in his study of suicides by poisoning, that as arsenic rat poisons were replaced on the shelves by non-arsenical formulations in the twentieth century, widely available arsenical weedkillers became the method of choice of those determined to obtain arsenic for the purposes of self destruction.[[113]](#footnote-114) The arrival of a new herbicide also provided a new chemical to poison oneself with, despite the lack of arsenic and many declarations that it was harmless (when used as directed). Therefore, the arrival of paraquat weedkillers, both agricultural and domestic variants, was another choice among many products for suicidal users.

Perhaps another consequence of reporting fatalities from accidentally ingesting the chemical was that deliberate poisonings started to occur more frequently. The role of paraquat in suicides was not explicitly mentioned in the mainstream press until 1972 when the Mail carried their first report of a suicide using paraquat.[[114]](#footnote-115) This followed their investigation earlier in the year into how easy it was obtain Gramoxone.[[115]](#footnote-116) The medical press had carried stories of suicides, from the very first and unusual suicide in Israel,[[116]](#footnote-117) as they correctly foresaw that the burden would fall to them. Generally, paraquat in the form of Gramoxone was drunk.

Weedol featured in numerous para-suicides (“failed suicide attempt” being considered unsatisfactory as patients did not want to die but were using self-poisoning as an expression of distress[[117]](#footnote-118)). The reports in medical journals of this use of the domestic chemical do not always state whether the user knowingly chose this weaker form as a distress signal, or because they were unaware that the paraquat reported on in most news stories was actually the more potent form Gramoxone.

Clarke discusses ease of death in his thesis, identifying those in the medical profession as choosing methods that would be as swift and painless as possible. Access to poisons demonstrated patterns where women used domestic substances such as disinfectants, agricultural and horticultural workers and that carbolic acid seemed to be used by residents of large towns.[[118]](#footnote-119) Users of paraquat for this purpose were not just those with legitimate workplace access to the herbicide, as Howard summarised in his study. Most of the women were described as housewives, with only one having access to it through work, and around half the number of people “had no entitlement to access” Gramoxone. Howard also identified a seasonal peak (May to July), which is when paraquat could be expected to be used domestically.[[119]](#footnote-120) In the use of and most deaths from paraquat poisoning were anything but easy. The agonising decline of patients was described in any news article about the lethality of paraquat, communicating to would-be users that this was not an “easy way out”, even if it was certain.

Murder

Murder was another misuse of the herbicide, as until 1974 Gramoxone did not have an especially offensive taste or smell,[[120]](#footnote-121) so could it could surreptitiously administered in sherry, in cups of tea or mixed into stews without suspicion from taint or residue (arsenic left white powder in drinks and soups[[121]](#footnote-122)). Paraquat did not have any special observable symptoms that would initiate detailed chemical analysis of blood or urine to bring the poison to light, and a poisoner could feign ignorance in order to delay or withhold appropriate treatment, ensuring success in terms of dispatch and remaining undetected.

In 1974 the first trial of a murder using paraquat, in the form of Gramoxone, was reported on. The Daily Mail followed that trial doggedly over 12 articles, and it was followed closely by other newspapers as well including the times which highlighted the novelty of Gramoxone used in this way. Regardless of which paper carried the reports, the poisoners were described as adulterous, jealous men and women, in turbulent, unconventional relationships. Poisoning is often thought of as a method used by women,[[122]](#footnote-123) but in the cases reported on in the newspapers, it was used about equally by men. Tabloid newspapers went into sordid, salacious detail about the complicated personal relationships. There was a subject on which the newspapers remained quiet. In two separate cases, the accused (and convicted) poisoners even stated that she had got the idea from a story in the newspaper.[[123]](#footnote-124) This raises an interesting question of responsibility for copy-cat behaviour triggering. In contrast to the coverage of murders in newspapers, murder is barely mentioned in Hansard, where accidental poisoning and intentional self poisoning were the principle concerns. This misuse of paraquat, especially in relation to domestic relationships, even became news when it was jokingly hinted at. Here the phrase 'Have you any paraquat? We've had another row' was taken to mean that the wife really did want to get rid of her husband.[[124]](#footnote-125)

A peculiar effect of this research into the misuses of paraquat preparations is to reveal an alignment of adultery and weeding. Read with the knowledge that paraquat had played a part in the dispatch of unwanted wives or husbands, ICI's 1978 advertising slogan 'Stop weeds going to bed with your flowers'[[125]](#footnote-126) can be given an additional layer of meaning. Even if the advertising agency had jokingly tried to make the link explicitly, ICI would never have condoned the misuse of their product in this way.

*Figure 2: Graph showing the focus on accidents, murder and suicide using paraquat weedkillers.*

The graph in Figure 2 shows the frequency of reports in the Daily Mail on paraquat involved in accidents, murders and suicides. Accidents might be reported as the outcome of a coroners report, or they could regularly check in with a poisoning victim. Crime is inherently newsworthy, readers are interested by it and the length of trials provided regular opportunities for coverage. This explains why the incidence of stories featuring paraquat as a murder weapon is so high, not that there were a great number of poisonings happening. Suicides were comparatively rarely reported. What the graph demonstrates is that as knowledge of paraquat ingestion being fatal became more widespread through the reporting of accidental poisoning, intentional paraquat fatalities also had to be reported.

Fear and Disruption

Another form of abuse was the threat of paraquat poisoning, used by extortionists and saboteurs.

In 1974 a man was jailed for attempting to blackmail the CocaCola company by threatening to put paraquat into 200 bottles of the drink.[[126]](#footnote-127) In the approach to Christmas in 1982, the Animal Liberation Front warned that they had poisoned turkeys for sale in Harrods and Woolworths,[[127]](#footnote-128) as well as a cluster in Bristol supermarkets and butchers.[[128]](#footnote-129) [[129]](#footnote-130) No paraquat was found, but the withdrawal from sale, the disruption and anxiety it caused show that the threats were taken seriously. Shoppers at Safeway supermarkets were the target of random poisoning threats, in 1981[[130]](#footnote-131) and 1987.[[131]](#footnote-132) In an attempt to deny the blackmailer the satisfaction of creating a stir, there had been a six week media blackout while the police and the supermarkets worked on the issue.[[132]](#footnote-133) The supermarket users were surprisingly tolerant of the risk, citing their experiences with bomb threats and explosions. Some declared that by continuing to shop there, they were defeating the extortionist’s aim of disruption. They also trusted the vigilance of supermarket employees and their own ability to spot tampered packaging.[[133]](#footnote-134) The blackmailer operating in 1974 was certainly at an advantage for novelty but that year a stenching agent was added to Gramoxone which could have tipped off recipients of their poisoned food. If Weedol was used, as the newspaper reports are unable to say which form the adulterant was in, the would-be poisoners could have made up a stronger solution or they could have followed the instructions.

**Educating Users and Abusers**

Users (and abusers) were given information, or educated, through a variety of sources. They had material from or vetted by the company itself, such as advertisements, labels and packaging. Labels and packaging had also been scrutinised by government committees, so these sources can be trusted as accurate. Information on the herbicide was also offered through newspapers, which carried advertisements for the products, as well as features which mentioned it. Advertisements and garden features have already been considered, so this section will focus on the other types of information disseminated by newspapers. Most importantly, this information was about the harm that paraquat could cause when misused. Accidental poisonings as news items meant that paraquat left the confines of niche gardening, farming columns, and the paraquat's potential to cause serious harm became more widely known.

The BMJ editorial demonstrates that children had been poisoned from 1967.[[134]](#footnote-135) Popular newspapers had run reports of adult and child poisonings since 1968, and tallying these up shows that there was not a great difference in the numbers of children affected when the Daily Mail carried out its investigation in 1972. Nevertheless, it stated that the campaign was to improve the safety of children.[[135]](#footnote-136) There was a big rise in paraquat poisoning stories from 1971 and I initially thought that the trigger for the Daily Mail to start reporting on deaths was not necessarily that they were becoming more frequent, but that they were no longer just affecting adult workers. This could not be the case, because there were examples of accidental weedkiller (which is plainly Gramoxone) related deaths of children and teens being reported. Perhaps it was to do with a lack of clarity about regulations on sales, the presence of Weedol on the market and potential for domestic users to seek out paraquat and equate stronger with better, or just pure horror at how a chemical that could lead to such an agonising death could be so widely available.

Consequences of misuse were not explicitly laid out for those who read ICI's instructions. 'Not to be taken' was not further explained as being potentially fatal, 'Wash off splashes' did not detail that it would burn the skin. Newspaper stories were one of the main ways that these consequences were publicly examined and disseminated. Despite fatal incidents occurring since 1966, none were reported in newspapers until 1968. Some agricultural users, who should have been familiar with the warnings on packaging, claimed to have been unaware of the risks associated with the chemical before they read about poisonings in their daily paper.[[136]](#footnote-137) This perhaps indicates how instructions and warnings on labels are not always read carefully and the consequences of failing to adhere to the precautions given were not fully comprehended.

The earliest newspaper report of a fatality connected to paraquat does not name the weedkiller, leaving readers no wiser, although it referred to a 'liquid weedkiller' that 'resembled a soft drink',[[137]](#footnote-138) which 'looked like Coca Cola' and the particular effect on the lungs.[[138]](#footnote-139) These descriptions were used repeatedly after this first exposure to the terminal consequence of swallowing paraquat. What caused this story to be on the front page, was not the involvement of the new weedkiller but that it was Britain's, even Europe's, first lung transplant in 1968. The story is also one of 15 year old Alex Smith's accidental paraquat poisoning.[[139]](#footnote-140)

During the same month that the transplant took place, the Essex branch National Farmers Union wanted the danger of Gramoxone to be emphasised on the label.[[140]](#footnote-141) Later that year, paraquat left the confines of niche gardening, business and farming columns when fatal accidental poisonings started appearing as news items in their own right. The first was the death of 6 year old Beverley Pollitt, who drank paraquat from a lemonade bottle.[[141]](#footnote-142) This case was particularly interesting because the father worked for ICI and had asked another ICI laboratory worker with access to Gramoxone, to get some for him. None of the other cases presented in newspapers had such a close connection to the chemical company and no others hinted at any repercussions for the supplier of the chemical.

When liquid formulations of paraquat were put on the Home Office poisons list, newspapers carried this news and took care to explain the granular Weedol was exempt, even if they did not say that it was less concentrated.[[142]](#footnote-143) Publicising the categorisation of agricultural paraquat concentrates as poisons can be compared to the classification of substances that could be used for sabotage. There was reluctance to let this list become common knowledge by publishing it full in journals, in case it prompted people to use the chemicals maliciously who otherwise would not have used them in this way.[[143]](#footnote-144) There does not seem to have been this type of discussion concerning paraquat.

The BMJ article on the Alex's lung transplant (although he was not named in the article, only described) noted that he 'had no previous significant history and he was a well-balanced, intelligent, and stoic individual'.[[144]](#footnote-145) This was a departure from PPL's list of poisoning occurring in 1966 and 1967 which was submitted for review by the Scientific Subcommittee on Poisonous Substances Used in Agriculture and Food Storage. The Irish and Scottish incidents are described in a way that emphasises the human error in using the chemical, 'patient was drunk when he consumed the chemical' and 'a mentally retarded man drank Gramoxone in mistake for wine' as well as the explicitly prohibited behaviour, repacking, into beer bottles, and storing them among other drinks.[[145]](#footnote-146) By describing Alex in these ways, the authors of the paper highlighted how the accident could happen to anyone.

The papers kept a running totals of deaths, continued calling for better retail practices, clearer labelling, and more thorough governmental approval processes. As described by Lean, the media tend not to be good at reporting processes, although they are good at reporting events.[[146]](#footnote-147) This, along with the subject matter's potentially difficulty to work into an intriguing, fast paced or racy expose, perhaps explains why calls in the media for action did not extend to an in depth examination of the approval processes that paraquat herbicides had already been through. Could the Pesticides Safety Precautionary Scheme very low rate of rejection and way of working informally with chemical manufacturers[[147]](#footnote-148) be made into a compelling story? Perhaps not in the Daily Mail. The paper could have taken a stance against the danger of paraquat by not running advertisement for Weedol, but did not. It would have cost them a vast amount of revenue, and the problem was strictly with a product that they did not advertise. That the paper ran their investigation into the availability and lethality of Gramoxone while continuing to carry regular advertisements for Weedol and other ICI garden care chemicals, was not an unusual situation. Martens and Scott found that Good Housekeeping magazine also raised concerns over products at the same time as advertising them.[[148]](#footnote-149)

The Daily Mail took a particularly active role in educating readers about the dangers of paraquat which can be seen in the MAFF files, in the form of requests for information from their reporters. Other newspapers are not mentioned in this way in the files, although the Consumers Association contacted the Ministry in relation to the preparation of their feature on paraquat in February 1973.[[149]](#footnote-150) Civil servants’ reactions to articles from the Daily Mail show a mixture of relief that the paper was getting across information about storing chemicals safely and following instructions for safe use, in fact so effectively that DA Wrigley, member of the Poisons Board, wondered ‘whether there is much scope for useful Government publicity on top of all the educative publicity already given by the newspapers to paraquat accidents’.[[150]](#footnote-151) There was also irritation that the journalists were misreporting and mangling facts, even that they were in direct contact with ICI and PPL representatives and getting their information from sources other than MAFF.[[151]](#footnote-152)

The 'good deal of Press publicity' over deaths from paraquat poisoning 'which have usually resulted from the carelessness of individuals' was pinpointed as the cause for public concern which prompted stricter controls on the sale of Gramoxone. The letter between MAFF civil servants that detailed this change also laid out how this was really only superficially stricter, as 'all householders are authorised to give certificates certifying a person to be one to whom a poison may properly be sold' according to Rule 36 of the Poisons Rules 1972. The letter takes care to mention that domestic Weedol is exempt, but does not mention the formulations containing paraquat that would come under this rule, further obfuscating where danger should be looked for when discussing paraquat.[[152]](#footnote-153) How widely known this was is unclear, but it was definitely not part of the press release heralding the change and not included in news reports of the change.[[153]](#footnote-154)

In 1973 Dr Matthew of the Poisons Board blamed what he called ‘disproportionate’ media coverage given to paraquat deaths for the fact that in Scotland, the number of accidental deaths from paraquat was overshadowed by the number of suicides with the chemical.[[154]](#footnote-155) Perhaps in investigating and reporting how easy it was to obtain Gramoxone, or how much was needed to have a fatal effect, media reports effectively perpetuated the misuse of paraquat.

Why might the brand names be used inconsistently in newspapers?

Newspaper articles at the start of the spate of accidental poisonings initially simply referred to 'weedkiller', which would be fair enough as swallowing any sort of weedkiller could be expected to have a life threatening effect. Indeed, civil servants lamented that they did not understand why the bipyridyl herbicides were singled out in this way.[[155]](#footnote-156) Then as the stories were elaborated on or became more numerous the identity of the weedkiller was presented. Each of these accidental poisonings could be attributed to the agricultural herbicide being taken from a workplace, some have said stolen, then stored and labelled inappropriately in a domestic environment. It was the chemical paraquat, rather than the brand name Gramoxone, that was held accountable.

Only ICI made paraquat so whenever paraquat was mentioned, ICI were implicitly involved. Avoiding the brand name would not achieve the same level of anonymity as a product that was made by lots of different companies, for example 'bleach' as opposed to 'Domestos'. If the papers had been trying to avoid singling out an ICI product as related to horrific poisonig cases to protect themselves from being accused of tarnishing the company's reputation or campaigning against them, they were inconsistent, because sometimes it was necessary to use the brand names Weedol or Gramoxone.

Farmers and market gardeners would not have got their information about new agrochemicals from newspapers; they would have been accessing specialist publications, or receiving promotional material direct from the manufacturer. In agricultural columns as part of a general daily newspaper, there is less need to be consistent, as the majority of readers are unlikely to encounter this chemical in everyday life.

Where gardening columns promoted Weedol to gardeners, they would also be backed up by more detailed material in specialist publications, but also by adverts for the product, which were often carried on the same page. A reader motivated to try out this product would have been primed to look for the word paraquat and found it in the advert, because they all proclaimed this active ingredient. Many of the adverts featured either an illustration or a photograph of the packaging itself, which was designed to be informative, and the name paraquat featured on the packaging, it was not hidden from the user. There may also have been a practice of not favouring named brands, shown by the propensity to give multiple options where possible, but in the case of paraquat, there was only a single brand so this was unavoidable.

However, in cases of poisoning, it may have been less alarming for readers to be more accurate and refer to the agricultural variant as such or by its brand name Gramoxone. It was rare that newspapers outright, and mistakenly, named Weedol as the culprit in accidental poisonings, but for brevity and impact in reports of these fatal incidents, the distinction between Weedol and Gramoxone was allowed to become blurred.

To a casual newspaper reader without their own experience of the products, who was not closely reading stories, which were spread out over time, it would be easy to come away with the idea that all paraquat products were somehow imbued with the intention of wreaking death. The general confusion can be illustrated by an exchange in the House of Lords, where Baroness Masham of Ilton asked why when she bought Weedol, the retailer did not volunteer the information, and did not know, that the product contained a poison.[[156]](#footnote-157) In this case, other peers corrected the Baroness was about the difference in concentration of paraquat.

Public Warnings about Paraquat

Another form of raising the profile of paraquat as a dangerous chemical, was the issuing of public warnings in relation to loss or suspected theft of Gramoxone and application of dilute paraquat. Newspapers carried stories of police warning the public with loudspeakers or going door to door to announce the presence of paraquat in the residents' environment. One incident involved containers going missing from the back of a truck[[157]](#footnote-158) and a locked garage,[[158]](#footnote-159) another involved containers of paraquat getting swept overboard from a container ship with the possibility of them being found washed up on a beach,[[159]](#footnote-160) a further episode was when a plant nursery sprayed their property and the spray drifted onto residents gardens,[[160]](#footnote-161) and yet another when a bramble patch was sprayed and children discovered to have eaten the blackberries.[[161]](#footnote-162)

The possibility of large containers of concentrate being unaccounted is understandably troubling, but where warnings were issued following the use of diluted paraquat, seems to be an over-reaction. Howard showed that when diluted according to the instructions, the concentration would not be expected to be harmful.[[162]](#footnote-163) Therefore, this type of activity could have stirred up unnecessary alarm. It also did not improve the understanding of the distinction between agricultural and domestic concentrations, of the low concentration that paraquat was applied at, or the circumstances when it really was harmful. In the desire to protect the nonuser public through these dramatic methods, the warnings were potentially scaremongering for those who received them.

**Disciplining Misusers**

For those who had misused the herbicide as an insecticide, a firmly worded letter to the national newspaper that carried the stories of their misuse appears to be the only discipline, which is really an attempt to further educate people about the correct users and uses for Gramoxone, as separate from the users and uses of Weedol. The misusers are held up as misguided, clearly using the product for something that it was not intended, and their own harm followed logically.[[163]](#footnote-164)

Misuse that resulted in the accidental death of a relative does not appear to have been disciplined, there are no reports of any further consequences for the person who brought the agricultural concentrate into the house, despite the fact that this was a prohibited action. It must be assumed that the traumatic death was discipline enough, and those people often blamed themselves and took responsibility for what had happened. In the case of Beverley Pollitt, a prosecution of the man who removed the paraquat from ICI was reported in The Times, demonstrating that there was a potential for additional discipline.[[164]](#footnote-165) However, the liberation of paraquat formulations from the ICI plant was not uncommon: it 'leaked out of the plant like water off a roof' according to someone who did not have any connections with the plant, other than living in the area.[[165]](#footnote-166) On the subject of how a person came to be in possession of a forbidden substance, journalists were silent.

In 1968 when liquid preparations of paraquat were included in the Poisons List, retailers were blamed by ICI as having broken their conditions of sale: to not repack the chemical, or to allow it to be sold to people who were not market gardeners or farmers.[[166]](#footnote-167) In 1967 Plant Protection saw fit to send what they called a 'strongly worded letter' to its main agents and distributors reminding them about the dangers of selling Gramoxone that was not in its original container.[[167]](#footnote-168) A case reported in a 1968 Cambridge newspaper described a store that sold Gramoxone in a reused lemonade bottle, delivering it to the purchaser's doorstep. Luckily no-one was poisoned, but the chemist was found guilty of gross carelessness and fined.[[168]](#footnote-169) Where Gramoxone was sold to an amateur gardener which resulted in a fatal poisoning, the Mirror reported ICI as criticising the vendor as 'silly and irresponsible'.[[169]](#footnote-170)

Journalists remained professionally objective in their reporting of accidental poisonings with Gramoxone, although they did not mince words when they could be delivered from authority figures. William Boon, father of paraquat, was reported as attributing accidental deaths to 'human stupidity'.[[170]](#footnote-171) Keeping Gramoxone in unmarked, reused bottles was 'asking for it', The Times reported coroner Donal Summerfield as saying.[[171]](#footnote-172) Coroner Roger Stokes was gave good copy for the Daily Mirror when he described the 'monumental folly' and 'disgraceful act of carelessness' that putting weedkiller in 'tempting bottles' was, and compared it to 'putting fireworks in a box labelled baby powder.'[[172]](#footnote-173) As poisonings of this type accumulated, a coroner was reported as frustratedly saying 'when will the public learn?',[[173]](#footnote-174) but the reporters at the paper did not expand or moralise on the subject of those who chose to use Gramoxone at home.

**Reassuring Users and Non Users**

Educational, profile boosting adverts were a staple feature of ICI's communication with the general public about their work and public relations for the chemical industry in general.[[174]](#footnote-175) ICI used these adverts to reassure users and non users that ICI products were of great benefit to their quality of everyday life. When Gramoxone was first launched, ICI's underlying promise was that paraquat would boost the nation's total area of agriculturally productive land thus improving self sufficiency in its food supply, and when exported overseas was set to guarantee riches to the UK's chemical industry. In post-war Britain which was rebuilding its economy and anxious about reliance on imports, this was an encouraging message.

Later, as paraquat poisonings accumulated and the United Kingdom suffered in a recession in the 1970s, ICI again ran a series of adverts to demonstrate the company's contributions to everyday life, and the British economy. 'Ideas in Action from ICI' was placed in the Daily Mail in 1974 which showcased three of their revolutionary products, with Gramoxone being first on the list, followed by 'Halodane, the world's most widely used anaesthetic' and 'BCF' liquified gas to put out fires 'saving precious seconds, precious lives.'[[175]](#footnote-176) In these adverts, their message was summed up 'Changes for the better, world wide'. In addition, ICI spelled out how much money the company was making, investing and recirculating through using '35 000 suppliers' in the UK, which seems to be an effort to show the company in a positive light when the country was in recession.

The timing of this campaign coincided with a milestone in paraquat's public history. On the day before the papers launched into nearly two weeks of daily court reports of the first murder case involving Gramoxone poisoning, they carried the reassuring message from ICI that they provided 'Changes for the better, world wide', with Gramoxone being among these products.[[176]](#footnote-177) I wonder if this was an exercise in damage limitation by ICI, in which they aimed to reinforce the positive benefits brought by paraquat ahead of its central role in a murder trial, as well as position it as an agricultural chemical, not a domestic one. This tactic is only successful where people pay attention to advertisements, which in this case is not measurable. The articles concerning the murder, contained the information that the chemical was not meant for use in situations other than professional weed clearance, but none expanded on the social usefulness of the chemical or the manufacturer.

Following the increasing negative publicity that paraquat received, agricultural users were anxious that clamping down on misuses of paraquat would make Gramoxone more difficult for them to obtain for legitimate and necessary purposes. They required reassurance that they would still be able to access the herbicide.[[177]](#footnote-178) The agricultural background that MPs and Peers came from personally, or represented constitutionally, were important in their arguments, as was the ability of Britain to produce enough affordable, safe food for a growing population.

Also included in those who needed reassurance about paraquat were those who made the chemical, and those who lived in those vicinity of chemical plants. Personal safety of plant workers was dealt with on a relatively private level, when protective clothing and ventilation were discussed at Poisonous Substances subcommittee meetings.[[178]](#footnote-179) Economic safety, or the desire to remain employed in a chemical company, was debated in parliament when restrictions on paraquat including potential withdrawal from sale. MPs representing areas where the chemical industries were large employers argued that jobs depended on the continued demand for paraquat in Britain and abroad, meaning that the MP for Widnes where ICI's paraquat factory was located appeared regularly in debate about the chemical.[[179]](#footnote-180)

Those who lived near chemical plants and saw (and smelt) ominous-looking, unknown vapours wafting into the sky, were treated to another interesting act of public reassurance following a fire at a warehouse which stored the chemical. This was the deliberate, public ingestion of homegrown vegetables believed by local gardeners and allotment holders to be contaminated. This is a similar tactic to the lecturer J Gordon Edward's ingestion of DDT[[180]](#footnote-181) and later of Minister of Agriculture John Gummer's beefburgers during the BSE scandal,[[181]](#footnote-182) to make a powerful statement about safety on an immediate and human level. Although these one-off events are unable to demonstrate long term effects of repeated exposure, Jasonoff describes this type of personal action as drawing on 'cultural commitment to empirical proofs: seeing is believing'.[[182]](#footnote-183) The beefburger stunt backfired, the DDT demonstration although repeated by other DDT advocates, feels misdirected as the point seems mainly to be about the DDT-eater's own isolated, personal health rather than DDT as part of an interdependent foodchain or network, but there is not evidence of the 'paraquat pie'[[183]](#footnote-184) being particularly well known. Locals of Woodkirk, West Yorkshire baked the pie containing rhubarb from allotments affected by a fire at a warehouse, which contained a number of different herbicides including paraquat. Much vegetation in the area had died and fish in streams were poisoned. Here the concerned local people used food potentially contaminated with a variety of pollutants, including herbicide, as a signal of their distress at living in an environment where they felt unsafe, where they perceived that chemical and allied industries, such as warehouses to store the products, were allowed to operate without consulting or informing the residents. The pie-eating politicians used paraquat's reputation as deadly and rarely successfully treated as the ultimate demonstration of 'putting their health where their mouth is', even if they did not have to live full-time in the worrying, polluted environment.

**Protecting Misusers**

ICI took steps to prevent misuse, but once the product was in the hands of retailers and users, the efforts of ICI and the Poisons Board could easily be ignored. When paraquat poisonings started to mount up, the problem was exacerbated by newspaper stories which provided would-be misusers with detailed information. By demanding that something should be done, a question was posed regarding how far the company should go in protecting people who did not follow instructions for safe use. In this section, we will look how medical staff dealt with poisonings, see some high profile tests of the enforcement of agricultural – domestic boundaries, and a variety of solutions that were proposed to avoid accidental poisonings.

Medical staff

In this editorial, attention is drawn to the UK case of a child sent home after he had appeared to have recovered from accidental paraquat poisoning, but died two weeks later. It is interesting to see the medical profession faced with this new chemical, sharing information and trying to learn how to deal with it to best treat the patient as well as protect their profession. Special care is taken to ascertain from the patient what kind of weedkiller it was, implicitly highlighting that doctors need to think beyond what worked for arsenic based weedkillers or other poisons which might not necessarily be appropriate in this situation. Readers are urged to consider the possibility of renal failure, as well as delayed development of lung fibrosis with an eye to these apparent early recoveries, which shows that the potential for effects to catch medical staff out who are not up to date with the newest chemicals available. It also puts expert medical technologies, dialysis, at the forefront of this.[[184]](#footnote-185) As more literature accumulated on treating these poisonings, medical staff had a better idea of what they were dealing with although there were still discrepancies between the amount ingested or absorbed and the outcome. It is telling that in 1987, once the dose has been established as being severe, the advice was to focus on palliative care, supporting the patient and their family towards the end of life.[[185]](#footnote-186)

Media investigation

In an attempt to identify how people were able to rail against the instructions given for safe use, reporters from the Daily Mail experimentally bought Gramoxone from different vendors around the country, and showed how easily Gramoxone could be purchased. Their investigation coincided with ten years of paraquat on the market and six years since the first fatality. They were able to show that the controls on its retail were not working.[[186]](#footnote-187) As described earlier, in raising awareness of the problem of sales, investigations like this not only warned in an attempt to protect, but also endangered. However, the attention given to the issue by the media helped to propell the issue of paraquat poisonings into Parliamentary discussions.

The involvement of MPs

The media attention caused people, users and non-users, concerned about the possibility of paraquat poisoning to contact government bodies[[187]](#footnote-188) and their MPs. Ahead of the Mail's big investigation, but following reports of accidental poisonings, the chemical name paraquat first appeared in Hansard in 1970. Joyce Butler asked whether MAFF would withdraw approval for paraquat following a number of accidents.The answer was negative: there was no evidence that the chemical was harmful to workers, when used in accordance to the instructions.[[188]](#footnote-189)

This was not the first time that Butler had spoken up in Parliament for users (and victims) of agricultural and garden chemicals. Butler had been very active throughout the 1960s when DDT, aldrin and dieldrin were the subject of public concern and came under closer scrutiny leading to a ban on their use. She spoke vociferously against the government produced booklet *Chemicals for the Gardener*, which contained recommendations to use the aforementioned chemicals without further information about their persistence, which she argued was necessary should the garden user want to make an informed decision about the wider implications beyond ridding their garden of pests that season. Again, full responsibility was placed on the chemical users to read and obey the information provided by the manufacturer.[[189]](#footnote-190)

Butler's question about revoking approval for paraquat, instead of for an inquiry to be launched, or health and safety procedures reviewed, looks like a knee-jerk or over-reaction in this instance, and an inflexible answer was given accordingly. Only after this media activity did MPs and Peers begin to investigate; buying paraquat products, noting whether warnings were given by the seller or on the container, experiencing for themselves whether the information on the containers was hard to read, or easy to understand[[190]](#footnote-191). Butler introduced debates that provided a forum for paraquat to be discussed in more detail and the weedkiller remained a topic of frequent questioning in the House of Commons and the House of Lords until the 1980s. One of the commonest requests was for figures on deaths attributed to the chemical and calls for stricter controls along with safer formulations, but there was a section of contributors who consistently spoke up for the benefits of paraquat.

A number of the participants in the parliamentary debates involving paraquat had experience of farming themselves, and were aware of the benefits of paraquat when used correctly as well as the tragic outcomes when it was not used as intended.[[191]](#footnote-192) They also called upon personal experiences to bring a more sympathetic and practical side to the arguments for changes to packaging and presentation: that labels are no good if you cannot read, so symbols and colours could be more useful, and recalling finding their own child playing with empty bottles or themselves as children finding slug poison delicious.[[192]](#footnote-193)

Restricting availability of drinks bottles

An alternative approach suggested by Scottish Medical Officer of Health (MOH) involved criminalising individuals who used soft drink bottles for the storage of anything other than soft drinks, through the amendment of the Soft Drinks Regulations.[[193]](#footnote-194) In the 1960s cash deposits on glass bottles caused the MOH concern that bottles which had been used to store noxious household or garden chemicals would then be returned tainted with residue.[[194]](#footnote-195) However, this was considered unnecessary by at those in London, as the Poisons Law already covered this the sale of poisons, but that it would be impossible to control how people use bottles.[[195]](#footnote-196) Even though the aim of eliminating accidental poisonings is honourable, administering and enforcing any such scheme would be cumbersome as well as ineffectual. If mystery poisonings traceable to bottles which had been through the returns system had not been a noticeable problem before paraquat, then fears of residue contamination would not have been something to worry about.

Retail

In 1974, further restrictions, at least in name, were placed on the retail of concentrated paraquat when it was counted as a schedule II poison, and the restrictions were well publicised through newspapers picking up the press release issued by MAFF.[[196]](#footnote-197) The seller was registered to the local authority as selling agricultural paraquat products, and they were expected to sell only to appropriate buyers. The buyers also had to sign a poisons book. As well as recording who was buying the product, signing the book was intended to bring home to the user that they should take special care with the product.[[197]](#footnote-198) All of these supposed safeguards could be, and were, easily ignored or circumvented by retailers or buyers, such as entering a false name into the Poisons Book.[[198]](#footnote-199) No matter how hard anyone wished, making buyers accountable for 'every single drop'[[199]](#footnote-200) would be impossible. Although rules were in place about the type of easily identified bottles with fluted sides that poisons should be kept in, there was nothing beyond a person's conscience, that would actually stop them from doing what they liked with the herbicide once they had bought it.

Although general advice to gardeners using chemicals in their garden was to avoid storing chemicals at all to remove the possibility of accidental poisoning,[[200]](#footnote-201) this advice was undermined by special price offers on Weedol. This could allow people to stock up and therefore store the product, making it available in the household for unintended users. There were no restrictions on the amount that could be bought, so if someone was planning to use the granules to harm themselves, they could easily buy the amount necessary.

Changes to formulation

Although PPL and MAFF representatives put full responsibility for accidents on the chemical users, and insisted that when the instructions were followed paraquat was safe, it would have been a public relations disaster for ICI if they could not be shown to have responded with some positive actions. Company spokespeople were readily contactable by journalists, who were able to portray the chemical company positively, as working hard to make the formulation of the very effective and valuable herbicide safer, and investing in to find better treatments for poisoning.[[201]](#footnote-202)

Technical difficulties had to be overcome in order to alter the formulation to one believed to be safer. There was also the added complication of imagined misuser behaviour such as “those who drank paraquat in mistake for something else tended in any case to swig their drink back, without stopping to savour the bouquet.”[[202]](#footnote-203)When reformulating Gramoxone to improve its safety, PPL looked to ICI discoveries, as well as outside the organisation. One of the additions was a triazolopyrazine made by FL Rose and colleagues, trialled by ICI as a bronchodilator, but rejected because it caused patients to be sick.[[203]](#footnote-204) Detailed records in the organisation meant that when an emetic was required to minimise intestinal absorption of paraquat, there were options in-house.

Bitrex, as an increasingly prevalent additive in household chemicals, had been raised by MPs as an option for making paraquat preparations safer. However, ICI had tried this early on and decided against including it as paraquat was already unpalatable, so this propriety and external to ICI chemical, would not make their products any safer to use.

The issue of Gramoxone being mistaken for dark coloured drinks presented a target for change. In a debate on Farm and Garden Chemicals more generally, although paraquat featured prominently, it was proposed that manufacturers should strongly consider the appearance of their products, including the colour.[[204]](#footnote-205) This echoed 1922 arguments about giving arsenic and strychnine formulations unmistakably vivid colours in order to avoid accidental poisoning.[[205]](#footnote-206) However, in the case of Gramoxone which was a dark liquid, it was much harder to add a colour that would be able to stand out. Making the formulation thicker, so it would be harder to swallow, or into a jelly-like formula were also options.[[206]](#footnote-207) I strongly suspect, based on the demand for the product by domestic users, that although this would have made it harder to put into drinks bottles, those other readily available domestic containers, jars, could still have led to accidental poisonings, merely shifting the problem from vessel to vessel. Moving to a granular formulation, like Weedol already was, does not appear to have been discussed.

Vale et al described in 1987 that paraquat itself causes nausea vomiting and diarrhoea due to its irritation of the gut. The paper also stated that all recent formulations contain an emetic, PP796, a phosphodiesterase inhibitor to directly stimulate the vomiting centre. Granular preparations (Weedol) contain magnesium sulphate, stimulating diarrhoea.[[207]](#footnote-208) These changes to formulation were made to try to eliminate the chemical from the system of the person who had consumed it \*need to find out when\*.

**After paraquat**

Following the drama of paraquat poisonings in the preceding years, new garden weedkillers were put onto the market with the specific claim that they did not contain paraquat. This can be interpreted as a reaction against the perceived danger of paraquat and fulfilling a desire among gardeners for an alternative product. In 1981, a new amateur or domestic weedkiller named DeeWeed, containing atrazine and aminotriazol, became available. Adverts for this product proclaimed, repeatedly, that it did not contain paraquat or sodium chlorate. This asserted that it was something more than the potentially explosive but otherwise cheap and readily available sodium chlorate. Harmlessness (when used as directed) is proclaimed, but “Do not expect anything to grow for up to 3 years” is the key message, as we see a plaid-shirted man bending over to aim his watering can at a pernicious weed in his crazy paving.[[208]](#footnote-209)

Leroco was another similar product, promising 3 weed-free years, ‘if a single weed reappears we guarantee to refund your money in full & without question’.[[209]](#footnote-210) Therefore, these weedkillers were not a direct competitor to paraquat based products although it emphasised its lack of paraquat as though it could be used in place of Weedol. These products were more likely to have been designed to cater for the user keen to keep a low maintenance patio or drive barren, the advert addressed ‘property owners’,[[210]](#footnote-211) not the gardeners that Weedol targeted. By the nature of the type of gardening featured in Weedol adverts, rose gardens, flower beds and vegetable plots, a degree of long-term investment in the activity is supposed, which means that those at least some of the those same gardeners are likely to be property owners too. Addressing ‘owners’ excludes tenants, who may also be keen to keep the outside areas of the property they inhabit tidy, but maybe this presumed economically lowly group of renters are not seen as reliable enough either weed regularly or handle chemical weedkillers. Leroco also used ready-weighed sachets to be dissolved in 2 gallon watering can, so this delivery method must have been deemed worthwhile by users and manufacturers.

Thanks to paraquat's inactivation by soil, Weedol was not displaced and continued to be available, showing that the diversity of householders' weed killing situations continued to call for a contact herbicide, where gardeners can rely on the soil being suitable to plant in immediately. It also shows that a significant majority of users who bought and used the herbicide were not shaken by the negative publicity that paraquat as an active ingredient received. ICI had been able to reassure users that their welfare was a concern by changing the formula, and by being involved in the development of treatment for poisoning victims. The amount of paraquat in Weedol was reduced by replacing half with diquat, but because of the niche it occupied when considered how it would be used in the garden, paraquat was not pushed off the shelves by other products.

**Conclusions**

Paraquat was certainly extremely effective at killing plants and PPL had worked hard to characterise the mechanism of action of plant death. This primary function won favour with agricultural and domestic users alike. But how did a chemical initially described as “moderately toxic orally” and “mildly irritant to the skin and mucous membranes”[[211]](#footnote-212) acquire such a sinister reputation? It seems that PPL were unable to accurately extrapolate the results of their animal tests and predict a fatal reaction in humans. Rats were perhaps an unfortunate early test model leading to some misjudgements about likely human effects*.[[212]](#footnote-213)* When further studies on treatment for paraquat poisoning were carried out, it became evident that dogs and monkeys had a much more similar and applicable response.[[213]](#footnote-214) All bodies involved in safety regulations made a judgement that all users would follow the instructions provided. This required domestic users to take responsibility for their safety and to treat the products as potent killers, to remain safe by following carefully crafted instructions.

I have shown that users shunned the demarcations set by Plant Protection Limited for two preparations of paraquat weedkiller, for two different user groups. The agricultural Gramoxone was invited into some private homes and garden, although it was never intended by the manufacturers for domestic use. Unfortunately this sometimes resulting in fatal poisoning, largely due to user error relating to reusing a beverage bottle, an explicitly prohibited action.

Users were not always as obedient, careful or competent as PPL hoped they would be. Analysis of accidental deaths by industrial experts pointed to carelessness and of human traits of alcoholism, mental illness or backwardness. Chemical companies position these as conditions of use that are out of their control. Retail was certainly a weak link in the chain, and an opportunity for domestic users to obtain possession of a substance that ICI and the expert committees had declared too dangerous and unsuitable for them. Enforcing the appropriate retail of poisonous substances was, and continues to be, difficult as both the purchaser and vendor can be motivated to get around restrictions.

Although the first accidental poisonings with Gramoxone were related to people using the herbicide as part of their work (though generally the poisoning did not take place *at* work[[214]](#footnote-215)), after Weedol was widely marketed to home gardeners, both in display adverts and in garden advice columns, accidental poisonings with Gramoxone spread to people who did not work with the chemical (see figure 3). Referring to the active ingredient “paraquat” in these advice columns created a desire for paraquat, and that inconsistent use of the brand name “Weedol” contributed to a lack of awareness about the distinction between the agricultural and domestic variants. Some domestic users were not uniformly willing, to pay more for a weaker, safer product designed especially for them. Some professional users of Gramoxone, also had domestic needs for a similar product and judged that their experience would enable them to safely disregard the agricultural-domestic division preferred by ICI and MAFF. Some domestic users of Gramoxone must have used it successfully for its herbicidal purpose because the number of accidental poisonings was quite low, so it was not inevitable that it would wreak destruction outside of the boundaries that had been set for it. Bringing agricultural chemicals into the domestic environment potentially exposed Gramoxone to a group who had been designated by ICI and the expert committees specifically as non-users, to be kept separate from all paraquat products. Children were believed to be particularly at risk of accidental poisonings, even though the actual numbers of accidental poisoning of adults and children were not very different.

*Figure 3:Graph using Daily Mail content data, showing that accidents with Gramoxone started being reported after Weedol was recommended in gardening columns and advertised.*

Users of paraquat based herbicides who did not follow the strict instruction to keep the chemical in its original packaging, put themselves and others (who would not have known of the instructions associated with the concentrate) at risk of mistakenly using the weedkiller as a drink, brought the chemical to wider attention. Focusing on these relatively rare incidents, inevitably made the problem appear more prevalent than it was. The seriousness of the outcome overshadowed the low likelihood of it actually happening, despite the “it could happen to anyone” angle that was taken by campaigners for stricter safety.

These safety campaigners were generally not the users. Farmers wanted more comprehensive labelling, but they did not want their access to the very effective herbicide impeded. Domestic users of Gramoxone, outside of the boundaries and clearly violating multiple instructions for safe use, were not among the voices calling for bans. Where there was an accidental poisoning with the concentrate, generally the way that the misuser had come to have a prohibited bottle of herbicide meant that they were aware that what they were doing was proscribed. They did not call for, or seem to expect absolute safety. Those using Weedol, conforming to the user categories set by PPL, appear untroubled by the presence of a poison in their preparation because this poison was what made the chemical effective. However, the appearance of products that were specifically marketed as not containing paraquat perhaps indicate that the manufacturers of those preparations had surveyed potential users and found paraquat to be a fearsome thing to be avoided. The use scenario was somewhat different and paraquat preparations continued to sell successfully where inactivation by soil was applicable to the users' gardening situation.

Overall, the number of UK deaths in relation to the total volume of paraquat sold and used was very small, the safety precautions were easily followed by the majority of weedkilling users and the herbicide was extremely effective. This meant that ICI and regulatory government committees could not seriously contemplate a ban, although ICI were directed to, and did, investigate and implement a variety of changes to the formulation. It also shows that despite the letters received by papers and MAFF from members of the public calling for the chemical to be banned or withdrawn from sale, most of the users were confident that they could use the chemical appropriately and safely, so continued to buy and apply it. This created an on-going demand for this type of speciality product which made the development of new Weedol formulations worthwhile for ICI.

Using weedkiller for human harm was not unique to paraquat herbicides. Misuses of paraquat products for this means were expected, as F Rose said about any new chemical ‘someone sooner or later tries to commit suicide with it’.[[215]](#footnote-216) The deliberate ingestion of Weedol granules before any deaths from the concentrated form had been publicly reported demonstrated the truth of that sad statement. As fears around paraquat were inflated by news reports, the chemical gained a notoriety that facilitated its use as a murder weapon and an agent of saboteurs and blackmailers. Media reports educated readers to these alternative uses, misuses of paraquat and in some cases enlightened them to more general safety regarding the storage of household chemicals. However, they also provided a primer on how to obtain and how much to use for anyone who wanted to misuse the chemical. Media reports of these fatal incidents, which for brevity and impact blurred the distinction between Weedol and Gramoxone, contributed to the unintended use of paraquat as a poison being perpetuated.

Those analysing reports of death from paraquat from the perspective of the company, took pains to highlight previous episodes of mental illness, alcoholism to demonstrate that these were not reasonable users. These were deemed situations that the chemical company could make useful protective efforts. ICI preferred to focus only on obedient users and their adherence to the instructions for safe use, written in the awareness of the range of effects that paraquat could have as an irritant and a poison. In these instructions, the company resisted giving details of the consequences, potentially leaving curious users who had read the instructions, unaware of why they should obey the instructions. ICI were concerned that people could be disinclined to use their paraquat products if they saw on the packaging that they were poisons. Newspapers, did not face this dilemma, instead operating on the principle that people should know the risks and took on the educational role of communicating the full dangers of paraquat to potential users and even existing users. However, in doing to they may also have contributed to the misuse of paraquat weedkillers. ICI did not accuse the media of doing so, but they understood the benefit of communicating the dangers of paraquat and used the media to condemn the disobedience of their instructions.

*Linking sentence goes here.* The imagined misuse of Weedol as a liquid form led to its granulation before it reached users. The actual misuses of both paraquat preparations led to substantial changes in the formulation and presentation of the products. Those determined to misuse the product still did, although through the process of reformulating, PPL and ICI were seen to be doing all they could to prevent accidents. Ultimately, the users were hard to control although some of their actions were predictable.

1. MAF284/307, 2, PS427 SC 1175, Scientific Subcommittee on Poisonous Substances used in Agriculture and Food Storage, “First Report on Paraquat”, 23.03.62 [↑](#footnote-ref-2)
2. Howard, 1982, *Paraquat: Uses and Misuses*, MD thesis, University of Edinburgh, p2. [↑](#footnote-ref-3)
3. Bradbury, McCarthy and Suckling, “Patterns of Innovation Part III – The bipyridyl herbicides, *Chemistry and Industry*, 4 March 1972, p195; [↑](#footnote-ref-4)
4. [↑](#footnote-ref-5)
5. Bradbury, McCarthy and Suckling, “Patterns of Innovation Part III – The bipyridyl herbicides, *Chemistry and Industry*, 4 March 1972, [↑](#footnote-ref-6)
6. DA Schon, 1963, "Champions for Radical New Inventions", Harvard Business Review pp77-86, p84 [↑](#footnote-ref-7)
7. Kennedy 1993 *ICI: The Company That Changed Our Lives*; Reader, 1970, *Imperial Chemical Industries A History*, Vol 2 [↑](#footnote-ref-8)
8. Bradbury *et al* 1972; Wain, “William Robert Boon. 20 March 1911-28 October 1994” *Biographical Memoirs of Fellows of the Royal Society*, Vol. 43 (Nov., 1997), pp. 134-141 [↑](#footnote-ref-9)
9. Kennedy*,* p136, p143-148. [↑](#footnote-ref-10)
10. “Killer chemical goes on Poisons List” DM 09.09.68, p6; “Menace of the weedkiller” DM, 11.05.72, p19; “The killer inside the bottle” DM 08.07.72 p20; “Should this killer be allowed?” DM, 30.08.72, p6 [↑](#footnote-ref-11)
11. Reader, p103-106 [↑](#footnote-ref-12)
12. Reader, p282-285. [↑](#footnote-ref-13)
13. ed. FC Peacock, *Jealott's Hill Fifty years of Agricultural Research 1928 – 1978*, (1978), p [↑](#footnote-ref-14)
14. Quirke, 2005 'From evidence to market: Alfred Spinks' 1953 survey of fields for pharmacological research, and the origins of ICI's cardiovascular programme', in V. Berridge and K. Loughlin (eds),*Medicine, the market and the mass media: producing health in the twentieth century*(London: Routledge, 2005), pp. 146-71 [↑](#footnote-ref-15)
15. Jealott's Hill 50 Years [↑](#footnote-ref-16)
16. Quirke 2005, p150. [↑](#footnote-ref-17)
17. Wain, p.139 [↑](#footnote-ref-18)
18. Kennedy, p146 [↑](#footnote-ref-19)
19. ICI success at Moscow fair 19.05.64, The Times, p18; SOS from Russia, 26.05.64, The Daily Mail p2. [↑](#footnote-ref-20)
20. Improved Type of Weed Killer, The Times, p 10, 23.08.62; Farewell to the plough, Winter, J., Daily Mail 29.08.62 [↑](#footnote-ref-21)
21. Jealott's Hill; How I transformed my pasture without the plough and got a higher milk yield, The Times, farming supplement p.ii, 07.12.64 and How I turned a problem field into productive pasture, The Times, farming supplement p.v 07.07.64 [↑](#footnote-ref-22)
22. ed. FC Peacock, *Jealott's Hill Fifty years of Agricultural Research 1928 – 1978*, (1978), p8. [↑](#footnote-ref-23)
23. Kennedy, p146 [↑](#footnote-ref-24)
24. Bradbury *et al*  [↑](#footnote-ref-25)
25. Wain, 1994, p140 [↑](#footnote-ref-26)
26. Kennedy, p146 [↑](#footnote-ref-27)
27. “Improved Type of Weed Killer” The Times, 23.08.62, p10.; “Farewell to the plough” Daily Mail, 29.08.62 [↑](#footnote-ref-28)
28. Where have all the workers gone? P. Bullen, Daily Mail, 22.04.66 [↑](#footnote-ref-29)
29. Jealott's Hill [↑](#footnote-ref-30)
30. “Higher fuel costs bring incrase in direct drilling by farmers”, The Times, 08.04.74, p16. [↑](#footnote-ref-31)
31. '...and in the Toolshed' A Correspondent, The Times, 23.04.66, p13; 'Know your Killers!' MacKinnon, CA, The Daily Mail, 06.05.67, p9, [↑](#footnote-ref-32)
32. Gramoxone Data Sheet, SC 1174, 3 pages. [↑](#footnote-ref-33)
33. [↑](#footnote-ref-34)
34. [↑](#footnote-ref-35)
35. Pl/w, SW 1169, Paraquat SC1174 draft SC1175 Advisory Committee on Poisonous Substances Used in Agriculture and Food Storage 2 pages. 20.03.62 (IMG\_3002 and 3003 in my files) [↑](#footnote-ref-36)
36. Howard, (1982) [↑](#footnote-ref-37)
37. Sub Committee: Minutes of 72 Meeting 20.09.62 (SC 1340) SW1069, 1015.4 [↑](#footnote-ref-38)
38. First report on Paraquat, p2, 23.03.62 [↑](#footnote-ref-39)
39. “Pesticides and Posterity”, *Horizon*, BBC Television, first aired 30.05.64 (accessed BFI) [↑](#footnote-ref-40)
40. [↑](#footnote-ref-41)
41. "Ends the work of weeding" Daily Express, 03.04.65 p14; "My Dad's a Weedol weeder" Daily Mirror, 06.05.67, p21 [↑](#footnote-ref-42)
42. *Chemicals for the gardener: for the control of plant pests, diseases and weeds*, MAFF, HMSO 1963 [↑](#footnote-ref-43)
43. Handyman Which?, February 1973, p10 [↑](#footnote-ref-44)
44. B&Q advert, Daily Mail, 25.05.88, p11 [↑](#footnote-ref-45)
45. Boots advert, 25% off all garden chemicals, Daily Mail, 19.05.79, p30 [↑](#footnote-ref-46)
46. “Super Summer” Timothy Whites advert, Daily Express, 17.05.68 [↑](#footnote-ref-47)
47. Woolworths advert, Daily Mail, 27.05.87, p17 [↑](#footnote-ref-48)
48. "Don't waste time with weeds" [↑](#footnote-ref-49)
49. [↑](#footnote-ref-50)
50. [↑](#footnote-ref-51)
51. 'There are two ways to weed your garden', The Daily Mail, 08.04.71 [↑](#footnote-ref-52)
52. “First in the field” The Times, supplement p. v, 02.07.63; “First in the field” The Times, supplement p.v, 02.12.63 These subtly different adverts did not actually mention the active ingredient paraquat, giving only the brand name Gramoxone W. The December advert identifies the product as qualifying for Ministry of Agriculture grants for pasture improvement. [↑](#footnote-ref-53)
53. “How I transformed my pasture without the plough and got a higher milk yield”, The Times, farming supplement p.ii, 07.12.64; “How I turned a problem field into productive pasture, without the plough” The Times, farming supplement p.v, 07.07.64 [↑](#footnote-ref-54)
54. “Amazing new weeder discovery ENDS THE WORK OF WEEDING” Spring 1965, Daily Express, 03.04.65, p14 as first instance. Alternated each week between Express and the Mirror until mid May. Did not appear in the Mail or the Times. [↑](#footnote-ref-55)
55. “End the work of weeding with Weedol” Weedol advertisement, Spring 1966 Campaign, Daily Mail, 16.04.66. This advert appeared in the Mirror and Express, but not the Times. [↑](#footnote-ref-56)
56. “My dad's a Weedol weeder!” Weedol advertisement, Spring 1967 Campaign, Daily Mirror 24.04.67, p21 was the first instance of this advert. There were two image variants, using the same text, which were run each weekend for a month (until 25.05.67). [↑](#footnote-ref-57)
57. “Don't waste time with weeds”, Spring 1967 Campaign. The Times 10.06.67, p8. On this date the same advert also appeared in the Express and Mirror [↑](#footnote-ref-58)
58. “Super Summer” Timothy Whites advert, Daily Express, 17.05.68 [↑](#footnote-ref-59)
59. "There are two ways to weed your garden", The Daily Mail, 08.04.71 [↑](#footnote-ref-60)
60. "Stop weeds going to bed with your flowers", Spring 1978 campaign, Daily Mail, 08.04.78, p32 [↑](#footnote-ref-61)
61. October Advert [↑](#footnote-ref-62)
62. “Don't waste time with weeds”, Spring 1967 Campaign. The Times 10.06.67, p8. [↑](#footnote-ref-63)
63. “Amazing new weeder discovery ENDS THE WORK OF WEEDING” Spring 1965, Daily Express, 03.04.65, p14;“End the work of weeding with Weedol” Weedol advertisement, Spring 1966 Campaign, Daily Mail, 16.04.66. [↑](#footnote-ref-64)
64. "Weedol kills weeds without killing the soil (or your back)" Daily Mail, 24.03.70, p3 [↑](#footnote-ref-65)
65. "Stand up to weeds!" Daily Mirror, 13.04.68, p20 [↑](#footnote-ref-66)
66. [↑](#footnote-ref-67)
67. "Even your garden needs spring cleaning" If you're houseproud you probably take pride in your garden too. [↑](#footnote-ref-68)
68. "How I love my Cavalier" advert Daily Express, 19.04.69, p8 [↑](#footnote-ref-69)
69. [↑](#footnote-ref-70)
70. SC 2376 Weedol Co-operator Trials Summary of Information obtained from questionnaires p3 [↑](#footnote-ref-71)
71. “Jobs for July”, The Times, 29.06.68, p27; “Some answers in the air”, The Times, 26.10.68, p26. In this later article, Roy Hay personally vouches for this use saying “My own few standard roses have...taken to sucking rather too much for my liking but we just water the sucker as soon as it appears with Weedol (paraquat).” [↑](#footnote-ref-72)
72. “Worth the extra pound or two” The Times, 07.09.68, p22. [↑](#footnote-ref-73)
73. "Gardening" The Times, 16.05.70, p26; "Gardening" The Times, 04.07.70 p23 [↑](#footnote-ref-74)
74. Take the backbreak out of weeding' Roy Hay, The Times, 17.06.67, p6 [↑](#footnote-ref-75)
75. 'Take the backbreak out of weeding' Roy Hay, The Times, 17.06.67, p6 (this article predominantly about ground cover was adjacent to a Weedol advert); 'A case for ground cover.' Times [London, England] 1 June 1974: 13, Roy Hay. 'Covering a lot of ground.' Times [London, England] 15 June 1974: 12. [↑](#footnote-ref-76)
76. "Gardening" The Times, 10.05.67, p5 [↑](#footnote-ref-77)
77. “To get plenty of vegetables, I give them plenty of help” ICI Garden Products Even the greenest fingers need a little help, Daily Express, 04.09.77, p22. This advert featured soil conditioner (mulch), granulated fertiliser, and Weedol. ; "Fast and easy. That's how I get rid of weeds" Daily Mail, 16.04.77 p31. Advert for Weedol and Pathclear. In both adverts, Percy is shown holding his pipe [↑](#footnote-ref-78)
78. Timothy O'Sullivan, ‘Thrower, Percy John (1913–1988)’, rev. *Oxford Dictionary of National Biography*, Oxford [↑](#footnote-ref-79)
79. Howard was an industrial hygienist, a trained medic, medical advisor to the Chemical Industries Association. He was intolerant of behaviour that deviated from that prescribed for correct use. He does not seem to have applied thought to *why* people used paraquat in some ingenious if misguided and ultimately harmful ways (louse removal [p70-71], creative mixtures [p74] or alternative concentrations [p68]). He admired the makeshift use of a plastic bag to protect sprayers from leaky knapsacks, but did not comment on the reasons why workers did not wear protective shoes or trousers (heat, comfort, cost) and were not more careful (education, experience, access to clean water, medical care, choice of language) nor did he look at communication between workers with respect to dealing with these hazards, or between workers and employer. Howard approached this problem from a completely medical/industrial view point, rather than from the user’s point of view. At the time he wrote the thesis he may have been associated with Plant Protection Limited, as he published a paper relating to this same work under their name. [↑](#footnote-ref-80)
80. Howard, p92, 113 [↑](#footnote-ref-81)
81. Howard, 216 [↑](#footnote-ref-82)
82. [↑](#footnote-ref-83)
83. “Paraquat poisoning Treated by forced diuresis” F. Kerr *et al* (1968), *BMJ,* vol 3, No. 5613, pp. 290-291 [↑](#footnote-ref-84)
84. Howard, p30 (oxygen), p169 (forced diruresis) [↑](#footnote-ref-85)
85. Kennedy, p.148 [↑](#footnote-ref-86)
86. HO305/32, Extract from minutes of 66th Meeting of the Poisons Board, 23.2.73 [↑](#footnote-ref-87)
87. [↑](#footnote-ref-88)
88. SW 1169, 182, PNM Moore documenting a telephone conversation with Holloway 26.6.68, National Archives, Kew [↑](#footnote-ref-89)
89. “The boy who thought he'd had a drink of pop”, Jane Gaskell, The Daily Mail, 24.06.71, p6. [↑](#footnote-ref-90)
90. “Information On Poisons” *The British Medical Journal* , Vol. 1, No. 5339 (May 4, 1963), p. 1220 [↑](#footnote-ref-91)
91. MAF 284/307, 104, Letter from R. Goulding (Guys Hospital) to JAR Bates, (MAFF Plant Pathology), 16.08.67 [↑](#footnote-ref-92)
92. Letter from AAB Swan (ICI)to F Stewart (HO, Poisons Board), 13.05.68 [↑](#footnote-ref-93)
93. Handyman Which?, Feburary 1973, p57 [↑](#footnote-ref-94)
94. SC3078 Paraquat and diquat liquid formulations summary of experience of human exposure December 1965 – May 1967, National Archives; “Girl drinks first and dies” Daily Mail, 30.09.72 [↑](#footnote-ref-95)
95. “Children steal deadly weedkiller” Daily Mail, 30.08.72, p3 [↑](#footnote-ref-96)
96. “The killer inside the bottle” Daily Mail, 08.07.72, p20; “Doctors save paraquat toddler” Daily Mail, 18.11.72, p3; “Alive! The boy who drank paraquat” Daily Mail, 06.08.82, p1 [↑](#footnote-ref-97)
97. “Bottle said lemonade but it killed Beverley” Daily Mail 14.08.68 (clipping from paper, no page, 'Poison tragedy of a gardener' Daily Express, 30.09.72, p15 [↑](#footnote-ref-98)
98. cannot find this but will continue hunting as was interesting – wife put it in fridge, did not know what was in it. [↑](#footnote-ref-99)
99. 'Poison tragedy of a gardener' Daily Express, 30.09.72, p15 [↑](#footnote-ref-100)
100. “Boy and Girl in lung-swop operation” Daily Mail, 13.05.68, p1 [↑](#footnote-ref-101)
101. SC3078 Paraquat and diquat liquid formulations summary of experience of human exposure December 1965 – May 1967; “Man drank weedkiller by mistake” The Times, 11.12.69, p 5; [↑](#footnote-ref-102)
102. SC3078, Paraquat and Diquat liquid formulations summary of experience of human exposure December 1965 - May 1967 [↑](#footnote-ref-103)
103. “Poison husband's grief”, Daily Mail, 23.11.77, p11 [↑](#footnote-ref-104)
104. Weedkiller was nice, dying child whispered' The Times, 19.07.72, p2 [↑](#footnote-ref-105)
105. “The boy who thought he'd had a drink of pop”, Jane Gaskell, The Daily Mail, 24.06.71, p6. [↑](#footnote-ref-106)
106. Howard, Paraquat Uses and Misuses, 1982, p65. [↑](#footnote-ref-107)
107. Handyman Which?, Feburary 1973, p57 [↑](#footnote-ref-108)
108. Fifth report on paraquat - Home Garden Use, MAF 284 307, doc 108 {IMG\_2917} [↑](#footnote-ref-109)
109. “Read the label”, Letter from TRL Waring ICI Plant Protection, Daily Express, 06.08.74, p3 [↑](#footnote-ref-110)
110. [↑](#footnote-ref-111)
111. [↑](#footnote-ref-112)
112. [↑](#footnote-ref-113)
113. Clarke (1993), p271 [↑](#footnote-ref-114)
114. “Paraquat: Firm urged to act”, Daily Mail, 31.10.72, p11 [↑](#footnote-ref-115)
115. “Should this killer be allowed?” DM, 30.08.72, p6; [↑](#footnote-ref-116)
116. “Poisoning from paraquat” The British Medical Journal, Vol. 3, No. 5567 (Sep. 16, 1967), pp. 690-691 [↑](#footnote-ref-117)
117. Millard (2012) [↑](#footnote-ref-118)
118. Clarke (1993) p3 [↑](#footnote-ref-119)
119. Howard (1982), p177 -183 [↑](#footnote-ref-120)
120. Weed killer tasted nice said dying boy [↑](#footnote-ref-121)
121. Arsenic, King of Poisons? [↑](#footnote-ref-122)
122. [↑](#footnote-ref-123)
123. ''I'll pole-axe you' a mother's shout at murder case', Daily Mail, 05.07.74, p13; “Poison stew wife is jailed for life” Daily Mail, 10.01.75, p3 [↑](#footnote-ref-124)
124. "Life for the killer of born-again Christian" Daily Mail, 28.03.87, p15 (shot dead) [↑](#footnote-ref-125)
125. "Stop weeds going to bed with your flowers", Spring 1978 campaign, Daily Mail, 08.04.78, p32 [↑](#footnote-ref-126)
126. “Jail for Coke blackmailer”, The Times, 23.11.74 p3 [↑](#footnote-ref-127)
127. “Anger over 'poisoned turkeys'” Daily Mail, 20.12.82, p10 [↑](#footnote-ref-128)
128. “Another turkey alarm”, Daily Mail, 21.12.82 p22 [↑](#footnote-ref-129)
129. '...and don't forget the weedkiller for the turkeys, dear.' Cartoon by Keith Waite, the Daily Mirror, 17.12.84 An illustration of a family of three terrorists, all clad in balaclava, writing a christmas shopping list. Although the chemical name or brands are not used, it is clearly a reference to the disruption of a Christmas 1982. [↑](#footnote-ref-130)
130. “More poisoned food may be lying in shops” The Times, 08.05.81 (front page leader, article p7); “Safeway food poison dose 'not lethal'”, The Times, 09.05.81, p2. [↑](#footnote-ref-131)
131. “Poisoner hits supermarket shelves”, Daily Mail, 22.06.87, p2 [↑](#footnote-ref-132)
132. “Poison food threat”, Daily Mail, 15.08.87, p2 [↑](#footnote-ref-133)
133. “Safeway counts cost of scare” Daily Mail, 09.05.81, p2. [↑](#footnote-ref-134)
134. “Poisoning from paraquat” The British Medical Journal, Vol. 3, No. 5567 (Sep. 16, 1967), pp. 690-691 [↑](#footnote-ref-135)
135. “Should this killer be allowed?” Daily Mail, 30.08.72, p6 [↑](#footnote-ref-136)
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