

Risks at Work in the Disinfestation of Rural Land Deriving From the Use of Fumigants Instead of Methyl Bromide

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AIMS

In ASP territory in Ragusa the land sterilisation working process based on the use of Methyl bromide, sustained by the local intensive cultivation of vegetables and flowers in protected structures, was very developed up to a few years ago and represented a significant working reality besides also being rather technologically advanced. Local firms, specialised in the process, had reached a high level of experience on the field so much so that they received intervention requests from all over the country. At times of greater expansion, in the 1990s, there were some ten undertakings which were quite active within the sector, with a workforce all in all exceeding 300 employees, mainly seasonal workers qualifying as disinfestation workers. The total amount of methyl bromide used annually by these undertakings exceeded 3,500,000 kg. (3,750,000 in 2002, SPreSAL Archive).

Crisis struck the sector after the use of Methyl bromide was limited. For environmental reasons this gas was actually included in the Montreal Protocol in the list of greenhouse gases contributing to the destruction of the ozone layer. Meanwhile, after an initial limitation of use with a relative quota of availability, the use in Italy of Methyl Bromide was prohibited as from the 1.01.2005, but for limited dispensations relating also to some specific uses in the agricultural sector. Following which, the hard times to find on the market sufficient product quantities for processing have led undertakings within the sector to search for alternative solutions relating to land sterilisation. Since 2010, the use of Methyl Bromide in Italy has been totally prohibited.

Of the new methods introduced to practise land sterilisation, the one based on chloropicrin is of major interest insofar as relating to safety problems at workplaces. This method, actually, for the purposes of work risks and the workers' safety, could be assimilated with the method base on CH₃Br. Chloropicrin too, like methyl bromide, is a toxic gas whose use is regulated by Roy. Dec. no. 147 dated 09.01.1927, and as such it is only allowed to be used by well-trained workers authorised in terms of the above mentioned royal decree; besides, since Chloropicrin and its formulations are also medical devices, their use and purchase is subordinate to the authorisation (licence) provided for in art. 25 of DPR 290/01.

The abandonment of fumigation on the basis of methyl bromide has upset the work sector. Not all undertakings within the sector were able to take up the prohibition of methyl bromide with a fast conversion to an equally effective alternative technology. The most unfavourable factor for the sector has been the introduction of non exclusive land sterilisation technologies, based on substances not requiring any specific authorisations, consequently in the direct availability of any agricultural holding wanting to adopt it. Only chloropicrin, being classified as a toxic gas like CH₃ Br, actually provides exclusive use by specialised firms possessing proper authorisation.

METHODS

The Prevention and Safety at Workplaces Service of the ASP Prevention Department, has launched a study aimed at recovering full awareness of the sector and to check: the work risks having to do with the adopted technologies, any possible effects on the health of workers who have already been exposed, the validity and effectiveness of the protective measures put into effect. All this in the light of the obligations and safeguard and prevention compliance provisions envisaged by Leg. Dec. 81/08 and subsequent amendments.

On the 30th May 2010 there have been identified and surveyed six functioning and operating firms within the sector, which have been contacted for the in-depth examination required for the study such as a description of the work cycle, the amount of substance used, the equipment used, the workforce, the recording of any accidents or pathologies linked to work risks. Besides, for five of them a further on site inquiry was made to effect a direct check of the technology and procedures used in land sterilisation.

Chloropicrin is an oily, colourless or faintly yellow liquid, denser than water and little miscible with it, with a freezing temperature of – 69.2 °C, a boiling point of +112°C, at which temperature it decomposes releasing phosgene and nitrosyl chloride. At ambient temperature it evaporates swiftly liberating fumes which are highly toxic to breathe. Its presence at low doses is noticed by feeling burning eyes and sensing an acute smell. It is irritable to the eyes, skin and respiratory mucosa, and harmful if ingested. The toxic action is mainly seen on the respiratory tracts, in fact if chloropicrin fumes are inhaled, these could cause serious harmful effects developing symptoms such as vomit, cough, serious breathlessness, pulmonary oedema. In its liquid state the product, if it comes into contact with the skin and the mucosa, causes serious burns owing to its strong irritating action. The limit value of exposure allowed is of 0.67 mg/mc (0.1 ppm) TWA.

RESULTS

From a study which has been undertaken it results that the actual firms working in the sector are six, that the workforce involved amounts to about 45 persons (mostly seasonal workers), that the amount of chloropicrin used during the past three years is on the increase, that accidents during the past three years have never been related to chemical poisoning.

Chloropicrin consumption declared in Ragusa Province

2007	2008	2009
230,316.5 Kg.	285,533.7 Kg.	315,930.7 Kg.

Given that the land sterilisation of greenhouses could be achieved with different techniques based both on purely physical action (e.g. solarisation), and on chemical action (e.g. fumigation), we will focus on the description of fumigation with chloropicrin. The process consists in impregnating the land to be treated with a mixture of water and chloropicrin, where the effective amount of dissolved substance generally falls between 15% and 20%. Impregnation occurs by means of a “machine” pumping into the ground, using the greenhouse’s drip irrigation system, while the previously prepared solution obtains its water from a reserve made available by the firm owning the land. The chloropicrin is added to the water through a measure dispenser connected with a tank inside the “machine”. Having set the solution with the required chloropicrin dose, the machine will start the treatment sending the solution to the tubes and sprinklers circuit positioned on the ground and connected to it. The impregnation takes place when the solution is dispersed into the surface strata of the ground where the sprinklers are to be found. The land to be treated, with all its network of sprinklers, is prepared beforehand, when it is all tightly covered and sealed with a black polythene sheet in such a way that both chloropicrin dispersion and the passage of light are reduced to a minimum. Between the ground and the polythene cover an air chamber is formed where chloropicrin fumes coagulate. The action’s effectiveness depends on the duration and persistence of chloropicrin in the ground.

Chloropicrin’s sterilising action usually persists for some four or five days up to its inactivation owing to degradation and halving of the concentration. Chloropicrin which has been distributed into the ground, generally only impregnates the surface strata in that it tends rapidly to rise again by natural evaporation, and this evaporation process is even faster if the ground is saturated with water. Exposure to light accelerates the degradation process for photolysis. Before re-entering treated land a safety period of seven days should be applied. Once this period has passed one could safely pass on to reclaim the land by removing the plastic sheets. For safety reasons, such an operation should be performed by workers from the same firm making the treatment, yet this is rarely the case since the undertaking prefer leaving the fabric as mulch.

All firms operating within the sector are local firms and used specialised labour. The approximate number of workers in the sector is of between 45 and 50 persons. The method could be considered tested having been in use now for at least five years. There have not been any accidents reported, neither from a check done with official accident data supplied by INAIL (the National Institute of Insurance against Accidents at Work) nor from an active review of the accident records of individual undertakings which have been contacted in the course of the present study. Actual available data of environmental monitoring relating to the presence of fumes show that in conditions of use with respect to hygiene and safety standards at work, the values for the presence of chloropicrin fumes in work areas, forming the subject of measurements, have never exceeded the permitted maximum levels (0.1 ppm), as per data supplied by a firm. There are no environmental monitoring measurements to this very day made by public bodies appointed to surveil safety at work and living places.

ARGUMENT

The technique of land sterilisation with chloropicrin, which has now been used for at least five years on the territory dedicated to greenhouse growing within the Hyblean area, has only partly substituted the important role undertaken by the preceding method based on methyl bromide. Actually, it has not had the same effect which the sector had with methyl bromide. The current sector is only a residue of what it once was. For the purpose of safeguarding the health and safety of the sector's workers, the method is not exempt from risks; workers, even if health epidemiological data on its use during these years do not give rise to any particular criticality, should be considered as being fully exposed to chemical risk as provided for in Leg. Dec. 81/08. The potential health effects can be prevented with a timely application of the protection and prevention measures regulated by Title IX Chapter I of Leg. Dec. 81/08. In particular, it seems evident that the most effective prevention measures to be adopted are: strict respect for all preparatory measures aimed at segregating the toxic gas and later, during the treatment itself, to keep the absolute no entry prohibition to treated areas for at least seven days or up to the time when one is certain, after proper measurements have been taken, that chloropicrin fume concentration levels dispersed into the air are below those permitted (0.1 ppm).