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NEW CONCEPTS AND DISAGREEMENTS IN THE EPIDEMIOLOGY OF TOXICITY BY AGRO-CHEMICALS IN THE CUT-FLOWER INDUSTRY[1]

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Abstract: *A different approach to the epidemiology of pesticide intoxication that proposes, at base, changes in prevention. The article begins with a reconceptualization of the intoxication process, from an integral perspective, recognizing its various domains and dimensions, and articulates to this an understanding of toxic- kinetic and toxic-dynamic aspects from a social framework. It takes on some points of disagreement and debate about toxicity and suggests new forms of protection.*

Keywords: toxicity, epidemiology, pesticides, work in floriculture

INTRODUCTION

At present, scientific knowledge has penetrated into many of the phenomena or components of the *intoxication process*: research into the dynamics of pesticides and agro-chemicals in general; the active and inert principles that provoke toxicity, including forms of dispersion and reactivity; general forms of exposure and routes of absorption; the toxic- kinetic and toxic-dynamic processes that occur in the human organism when the polluting residuals penetrate; and lastly the physiopathological processes that such residuals unchain in the human being. However, much less is known about the epidemiological processes that integrate this group of elements and the relationships between them. Such knowledge is necessary for understanding the typical modalities of intoxication among members of vulnerable groups in society, the only basis from which to arrange for effective forms of prevention. In other words, much more is known about how to treat individual cases of intoxication and immediate problems than about the globality of the problem and effective mechanisms for collective prevention.

It is as if we have an almost exhaustive supply of information of the component processes of the problem and have made some connections or empirical associations among these isolated phenomena, without having achieved an integral understanding of the totality or of the social contexts that frame and condition the entire process.

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Several disciplines can contribute toward an integrated knowledge of the health problems associated with contaminants of production; but from the point of view of human health, *epidemiological science* forms the basic resource in an analysis of modes of sickenss and of their relationship with sociogeographical/ecological contextual determinants.

The problem with which we are preoccupied-- knowledge of the modes of intoxication of groups of workers and of communities in a region producing cut flowers-- can not be investigated only by carrying out surveys and conducting isolated examinations to figure out tendencies, inductively. The clinical or individual-based evidence is important but contributes little to an epidemiological understanding if it works in disconnection with the reality of those afflicted. A study must also be conducted of the defined space (territory) in which collective intoxication is experienced and of the social forms there developed around natural bases. An investigation of an epidemic process like intoxication requires a deep understanding of 'the social'; in itself, and as it is developed in an ecological and geographical environment.

Each society, under determined historical conditions, generates its geography and models its ecology, and these provocative changes contribute, at the same time, to its own transformation and to its forms of illness and death; it is for this reason that we emphasize here the necessity to integrate social, geographical and ecological elements in the investigation of an epidemic process such as intoxication.

Moreover, *epidemic processes* do not show the same characteristics in every constituent group of a society, because neither their origin, nor their properties or distribution is uniform. For that reason epidemiology must discover the different ways in which an illness reproduces and expands among different groups of a collectivity which, in the case examined here, implies the need to figure out which social relations are invovled in causing a massive expansion of contact with toxic residuals of pesticides, and what are the ways of life characteristic of each group that facilitate family and daily lifestyles that become true *intoxication profiles*, which explain the different *modalities and grades of exposure*.

That the life of a group will be put in contact with contaminating substances depends in great measure on its ways of life and of the favorable or negative conditions that are imposed upon them in their social and cultural situation. There are diverse mechanisms that favor or limit the contamination of a collectivity, but these all depend principally upon the social position and the organizational and cultural resources of their members. These mark the said population's access to, and enjoyment of, conditions of life and ecology. At present, countless scientific reviews have been published on the deep contrasts that exist among the modes of illness and death among different social classes, gender groups, cultural/ethnic formations and even generational groups[3]; the important thing to understand is that each of these forms of differentiation in health-- among social classes, genders, ethnic groups, and generations – do not exist in isolation, but rather they form part of a structure of

[3] Bibliographical reviews on inequity in health have been renewed in magazines as "The Lancet"; "Social Science and Medicine"; "International Journal of Health Services"; and also in recognized Latin American journals such as "Cadernos de Saúde Pública de Fiocruz"; Salud Problema de México, etc., and also in official publications of the OMSOPS.

power that defines them and that molds the modes and styles of life characteristic to each group. In each social context it is necessary to specify the way in which a structure of social classes is reinforced, recreated, or reproduced in connection with other sources of inequality, such as ethnicity and gender [Breilh 1991, 1993, 1996; Hill Collins 1991].

In an *epidemiology of intoxication* it is fundamental to insert an analysis of problems such as the dynamics of pesticides in the atmosphere, forms of exposure, the different vulnerabilities of distinct groups to intoxication, etc. into an understanding of these macro-determinants, without which any attempt at interpretation would lack its fundamental explanatory base. Only a knowledge of all these relationships allows an understanding of the *collective patterns of intoxication*, within which processes of *individual intoxication* happen. In a flori-cultural region, for example, the transformation of agricultural space, the assignment of soil uses, the magnitude and mechanisms of contamination, the patterns of life of working women and men, the management of social responses to intoxication, etc. are clearly determined by the relationships of power that operate in the process of production, in the behavior of the State, in institutions, and in social organizations.

The present work attempts to emphasize the necessity for greater investigation along the line that we have described, and to summon debate on several disagreements that arise in the interpretation of key aspects of this problem. In this brief discussion we present an alternative approach in that discussion.

THE NEED FOR A NEW INTERPRETIVE APPROACH

Epidemiological knowledge cannot stop with the identification of variables and their correlation, an approach which would imply the reduction of reality to a single plane: that of empirical or directly observable phenomena, relegating to obscurity the plane of the generative processes, that is to say, that of their conditions and determinate relationships.

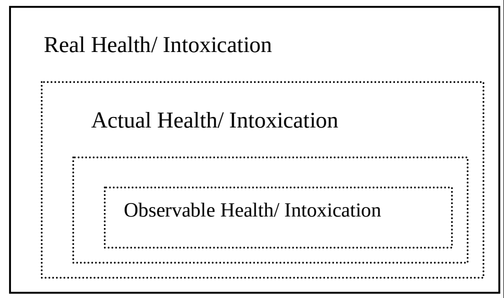
For that reason, in the last few decades, valuable methodological contributions have arisen from *critical epidemiology that, having been born in Latin America in the 1970s, is now gaining followers and is incorporating* investigators from all over the world. This tendency has pronounced the urgency of developing a *general theory of health* [Almeida 2001] that doesn't simply surpass the clinical mold under which epidemiology emerged, but rather overcomes psycho-biological and psycho-cultural models, and even the so-called semiological models, all centered in the notion of illness, in explanations closed to the world and immediate relationships within it, and that have not solved the crucial problem of epidemiological research: namely, to not only analyze the ‘pole of illness,’ but rather the ‘pole of health,’ to articulate the analysis of specific biological processes of morbidity with the socio-economic, cultural, political and geo-ecological processes of characteristic groups, and to draw from this a renovated perspective in which science opens up to a multicultural construction [Breilh 1994/97, 2001].

In contrast to individual-clinical knowledge, epidemiological investigations should draw inter-relations between three dimensions of health: *directly-evident health*; actual *health conditions*; and *real health*, or the complete reality of health [Breilh

2001b]. The breadth embraced by these three categories can be better understood with reference to figure N° 1, here applied to intoxication.

In intoxication, the directly detectable or verifiable aspects are those that can be observed in people; current illness is constituted by the determinate processes that are given in the typical ways of life of the community to which those people belong and in the daily lifestyles that are found among the families and the individuals; finally, real or complete illness embraces the widest of determinate processes, including historical processes that are determinate as inheritances that continue to influence present conditions of health. In other words, *observable intoxication* is the immediate thing that we see in patients (for example, neurological symptoms, cholinesterase reduction, elevation of the transaminases, damage to DNA in the lymphocytes, or suffering and mental deterioration); *current intoxication* is a wider dimension that also includes the plane of generative or decisive relationships as ways of life of the different social classes; *real intoxication* is the most complete dimension that embraces the anterior but also includes the general, macro-sphere, or wider conditionings, and the determinations of the past that have been transmitted genetically as mutations or aberrations that change the norms of the population's genetic reaction to the problem.

Figure N° 1
Dimensions of Intoxication



In figure N° 2, these dimensions of the intoxication have been exposed according to the different domains of the reality of the floriculture area, highlighting, in turn, the dimensions that form these domains, along with their *critical processes*[4]. It can be seen that the selected critical processes are divided into *structural processes*, *generative processes*, and *specific processes of health and morbidity*. Observe also that the critical processes have been divided into destructive (those that cause deterioration of the ecology and of health, increasing the conditions for intoxication), and protective (those that promote and protect a desirable ecology and human health, reducing the possibilitis for intoxication); from their analysis arises the possibility of figuring out *intoxication profiles* and *response-protection profiles*.

The *structural determinants* act as modes for the reproduction of the flower industry as a whole (productive logic; patterns of flower demand; characteristics and behaviors of the State; and regional geo-ecological conditions); at the level of social groups, they correspond to ways of life (working patterns and consumption; world-view and subjectivity; organizational forms and resources; particular ecological relationships) that determine patterns and grades of exposure/ imposition, modalities of absorption and deterioration, and the availability of appropriate protective resources. The *generative processes* are those that act directly through routes of absorption (inhalation, ingestion, or dermal) generating a toxic-kinetic process of bio-

[4] A c*ritical process* is an element of the epidemiological profile that stands out as an object of investigation and of transformation in a study; it implies a demand for intervention.

transformation, circulation, or fixation of the absorbed active or inert ingredient, and then a toxic-dynamic process in the sites of action. Finally we find the specific processes of health/ illness-mortality that result from the above .

Figure N° 2: THE PROCESS OF INTOXICATION: CRITICAL PROCESSES OF REAL, ACTUAL, AND OBSERVABLE INTOXICATION

DOMAINS	DIMENSIONS	STRUCTURAL DETERMINANTS		GENERATIVE PROCESSES		SPECIFIC PROCESSES OF HEALTH
		Destructive	**Protective**	**Destructive**	**Protective**	
GLOBAL	* *Determinating logic*					
	Productive	Recomposition (productive) Flexibilization Mode of production and technology of the green revolution	Just and ecological production Integrated ecological Management			
	Consumption	"Perfect flower"	Consumption of just and ecological flower			
	State	Deregulation	Protective, national and international, codes			
	**Geo-ecological Conditions*	Anti-technified distribution of soil use Deterioration of soils Loss of biodiversity	Planned assignment of soil use Protection of soil composition Protection of biodiversity			

DOMAINS	DIMENSIONS	STRUCTURAL DETERMINANTS		GENERATIVE PROCESSES		SPECIFIC PROCESSES OF HEALTH
		Destructive	**Protective**	**Destructive**	**Protective**	
PARTICULAR	* *Modes of life*			Mental and physiological deterioration of the worker		
	Work patterns	Distribution of noxious processes by area: Productive model; Subsumption or lack of worker control; High cyclical demand and lack of appropriate periods of rest; Thermal extremes and fluctuations; Dehydration; Repetitive movements; Strained postures; Carrying heavy loads; Ergonomic inadequacy of positions; Noise / vibrations Exposition to/ imposition of pesticides	IPM; monitoring and focussed use of pesticides. Organization and Collaborative actions Protective uniform (for toxic, temperature and noise) Tec. Hydration program Daily physical exercise; Ergonomic equipment; Programming of tasks in agreement with special conditions of gender (e.g. pregnancy) Secure transport	High emission and employment of hazardous substances with damaging capacity : Persistence Bioacumulation Biomagnification Potentiality of transport Routes of absorption (ingestion, inhalation; dermal) Forms/ Grades of Action of Toxics: Dose: High / low Mechanism: Permanent Chronic Eventual	Protecting norms and modalities of the code of conduct (CCI) Safety and Preventive System; Appropriate nutrition; Régime of rest and protective physical exercise	
	Consumption patterns	Alimentary limitation and deformation	Daily and peridic regime of rest; Cntinual improvement and education			
	Worldview and profile of subjectivity	Conformity; loss of identity	Personal and collective identity; ecological awareness and social solidary		Protecting community [psico] and cultural profile	
	Organizational Forms	Alienation, no organization	Organization and conscienious participation			
	Particular ecological relations	Contamination	Ecological Management			

SINGULAR	* Lifestyles * Genotypical and phenotypical processes			Critical processes of exposure Contaminating and deteriorating daily practices *Toxic-kinetic Processes* Biotransformation Circulation Toxic Initiator Tissular fixation	Practical daily protectors and healthy Physiological protectors: He/she reserves Detoxificating processes Immunologic processes Psico-family profile Protective	*Toxic-ynamic Processes:* Bio-accumulation DNA damage (mutagenesis, carcinogenesis, theratogenesis) Hepatic deterioration (hepatitis) Renal damage (glomerulonephritis, Respiratory damage Gastro-intestinal damage Inmunity disfunción, immunologic sensitization, hyperergy Dermatosis Neurological damage Reproductive health damage Depending on the dose and the frequency, it becomes a processes of: ACUTE INTOXICATION CHRONIC INTOXICATION

A NEW VISION OF THE EPIDEMIOLOGY OF TOXICITY IN FLORICULTURE

Global domain: Determinant Logic and the Organization of Flower Production

The production of cut flowers took off in the country with the mercantile globalization of the last two decades, a process characterized by a deep *productive recomposition*, which has been implemented through an aggressive flexibilization of working conditions.[5] [Breilh 1999].

The agro-industry of cut flowers is directly subjected to the conditions of an exacting market that demands a quality product by means of the application of extreme phytosanitary measures and of vegetable nutrition, with the rising intensive use of agrochemicals that claim to guarantee the "perfect flower" [Gaybor 2001; Velasteguí 2001].

In the Ecuadorian case the key elements that led to the establishment of the flower industry and their high rates of profitability have been a cheap labor force, a very favorable regulatory scheme, and optimal natural resources [Gaybor 2001]. In fact, the export curve grew exponentially from 1987 (US $3.6 million) up to 2000 (US $161.4 million). Demand volumes vary notably during the year and reach their highest peak in times like Valentine's Day, when companies double the demands to achieve the necessary productivity.

Although there is a considerable difference among the ways different types of flower companies act-- the truth is that only a minority (no mora than don't arrive at 15%), function under international labor and ecological codes—an intensely productivist mentality prevails that is expressed in an agroindustrial model based on: a) an agrarian logic of monocultivation and the technological conceptions of the green revolution, and; b) a productive model based on the maximization of profits and the minimization of social rights and of the protection of nature.

From an ecological point of view, the operating model is expanding without either regulation or agro-territorial planning in areas with alimentary agricultural potential and is provoking a generalized loss of biodiversity. The intensive use of water requires the captivation of large volumes—equivalent to those required for large urban populations— and at ridiculous costs, causing a deepening of the static level of underground water, with the consequent decrease of the flow of superficial waters [Sánchez 1997]. Preliminary observations indicate that cut rose farms may be consuming around 285 153 liters of water per week, equalling an average of 0.35 liters per stem [CEAS 2001]. In the farms that don't apply systems of environmental protection (green seal), the uncontrolled and intensive processes of applying pesticides and other chemicals do not only imply economic losses and waste, but also disproportionate mechanisms of control of pests and very high magnitudes of emission of pollutants that go out with the water remains, which are voluminous if

[5] The flexibilization of contractual relationships has revolved around a numeric adjustment in demand (numerical flexibilization) combined with third-party contracting (tercerization); a recalculation of wage to productivity ratios (salary flexibilization); and the creation of polyvalent working systems, internal mobility and cycical contracting of occasional laborers. All of which has been made possible by means of a deregulation or juridical setback in the norms of labor and social protection and the limitations to the right to organization.

one imagines that a small property of around 5 hectares under production can be using, according to experts, nearly a million and half liters of water per week.[6] The polluted waters flow from the greenhouses, from the drainages of water used to wash fumigation suits, and glides off from polluted vegetable remains, as well as from filtrations of uncovered soil cavities that favor an escape toward superficial phreatic layers; all of which is expelled toward the network of superficial and underground waters without a previous treatment for filtration and/or deactivation. Flower production generates a great quantity of toxic by-products, solid residuals, and polluted recipients even though there exist adequate and appropriate handling and recycling programs for these materials. Also, in spite of operating under greenhouses, gases or equally toxic vapors are dispersed into the air. The cyclical use of tons of plastics for greenhouses, does not only cause the pollution of the landscape, but they also project contamination by way of several mechanisms that havn't been resolved by an unregulated and distributive system of recycling polluted polyethylene. The ecological impact is distributed by water, air and soil contamination, provoking a toxicity in several animal species, but also damage to cultivations, elimination of beneficial organisms and frequently generating direct and crossed resistances. According to Velasteguí, the deterioration of agricultural soils is generally completed by a lack of reinstatement of organic matter, an imbalancing of nutritients, an absence of crop rotation, and an excess of salts [Velasteguí 2001]. To the mechanisms of direct contamination that the plantations cause without ecological management, can be added those that are mobilized by external agents, such as the recyclers/ re-users of polluted materials, the transport of contaminated working clothes into thousands of homes, and the discarded wood of many greenhouses that is left in the open and is used for domestic combustion [Andrango 2001].

In socio-epidemiology, flower production can be characterized as a form of agro-industry with high productivity and a generation of elevated levels of relative surplus value. The organization of work is subordinated to intensive productive rhythms and low levels of worker control (formal subsumption); stressful cycles of high demand lower considerably the organized moments for daily and periodic rest. The tasks in different areas (see annex N° 1) are organized according to an overload upon the labor force: whether by forced postures, the transport of weight and constant dehydration (such as the tasks of taking care of the flower beds, "laboreo", planting, "agobio" etc., of the areas under cultivation in the greenhouses); by the prevalence of repetitive and monotonous movements of the foot, on humid soil and placed before ergonomically incompatible equipment (such as the classification tasks like dispetalling, arranging stems by sizes, bunching, etc. in post-harvest rooms); by the subjection to extremely low temperatures and thermal fluctuations (as happens to workers packing flowers in the cold storage room); by the exposure to noise in the areas bordering the compost shredders, ventilators- that regulate the humidity and temperature of greenhouses - or irrigation pumps; the suffering of infections, especially dermal mycosis, by the use of boots without protection or contact with irritating substances; the affects to the

[6] Water that arrives to the farms already brings residuals of pesticides from agricultural areas, nematodes, which comes solidly with magnesium salts and calcium, generally bringing an alkaline pH and a decrease in its oxygen quantity (low ODB), it can carry heavy metals from industries (Tin, cadmium and Lead). Once used in the production of flowers, it leaves highly contaminated—when it is not treated in oxidation pools with aluminum sulfate and non active lime or filter boxes—, from the post-harvest, from the washing of protective suits, plastics and polluted materials, toward canals, or even the sewer network.

respiratory system by the inhalation of gases, powders and noxious smoke. But in addition to these problems, in this industry, the critical process that stands out for its capacity to cause health problems and to provoke the appearance of diverse illnesses, as will be explained later on, is the process by which workers are exposed to diverse agro-chemical products and intoxication.Clearly, a group of destructive processes can be observed that affects a laboring population, all the more vulnerable, due to being not well remunerated and subjected to extenuating rhythms of high demand and stress. Many of these processes are considerably attenuated in the plantations holding green and social seals, where the fulfillment of standards of the “international code of behavior” introduces several important protective and palliative regulations; unfortunately they are a minority.

The Products Used

Predominant forms of chemical-based pest management are not realized due to the absence of alternatives, nor strictly a problem of cost-effectiveness, but emerge from an agro-technical pattern (“green revolution”) that blindly grants primacy to the aggressive use of those products and the profitability of life. Modern systems, called IPMs (Integrated Pest Management), include many alternative techniques[7] have combined considerable effectiveness at reduced cost with a minimized ecological impact [Velasteguí 2001]. Although not in the field of floriculture, in our country the strategic importance of changing from an intensive use of pesticides toward an IPM system has been demonstrated in the northern Sierra in small agricultural production [Sherwood & Cole & Paredes 2001].

The range of agro-chemicals used in export-oriented flower production is wide and an itemized analysis of the products and their mixtures surpasses the limits of this brief essay, but some general explanations can be made at this time.

From the point of view of their use, the pesticides used in floriculture can be classified into: *fungicides* (protectors and systemic-- they penetrate vegetable tissues --, making up the major part of the most highly used products with light toxicity, recognized by their blue label); *insecticides* (contact and systemic, a number of which are identified by red labels, i.e. of extreme toxicity, and others by yellow labels, i.e. of moderate toxicity); nematicides (that exist as fumigating solutions or in volatile forms, and non-fumigating, which are, in their majority, of extreme or high toxicity, that is to say red label products); and the [acaricides] (the majority of which are also of high toxicity) (see annex Nº 2). In other words, except for certain insecticides, the [nematicides] and [acaricides], most of the products that are used, overall in farms carrying seals, are of limited toxicity. If the farms use a pest/ illness monitoring system and the corresponding focussed fumigation, and if they also use systems of integrated pest management (IPM), a considerable reduction of the contamination by pesticides is achieved [Velasteguí 2001].

[7] Alternative techniques like genetics (resistant varieties); agronomics (aeration and removal of soils, controlled fertilization); mechanical (manual cleaning); physical (solarization, water vapor, ultraviolet filters in plastics, ozone and ultrasound for disinfection of water); biological (antagonistic microorganisms— entomopathogens, predators and parasitoides—; vegetable extracts; animal extracts); legal (phyto-sanitary norms).

The damage capacity characteristic of the products, abstracting the social and geo-ecological conditions of their use, depend on their persistence (P); on their potential degree of bio-accumulation (Ba) in nature and in organisms; on their potential for bio-magnification (Bm) when entering into synergy with other substances;[8] on their potential distance of transportation (PDT), and on their toxicity (T). While the first three conditions tend to be intensive or independent of quantity, the measurement of toxicity, on the other hand, depends on the quantity used. For this reason it is preferable, for the moment, to not evaluate substances by means of classic parameters such as LD50—the lethal dosis for 50% of the experimental population-- that depend upon the efficiency of the substance's penetration from the site of toxic action, but rather to rely on internally calculated doses. The main concern should not be the evaluation of characteristics of isolated toxicity, but of the action gradiant that results from the magnitude of emissions [Mackay & McCarty & Macleod 2001]. Once emitted, the contaminant can achieve bio-accumulation in the water and food chains, and if they bear capacities common to organ-cloride pesticides that can stabilize themselves in these mediums, and which cause a degree of toxicity to organisms in the chains, then they can settle there for some time [Clarkson 1995].

From the point of view of epidemiology, the magnitude of emissions is generated by the mode of production, and the modalities of exhibition are conditioned by the modes of life and the organization of work [Breilh 1994/97].

With the purpose of facilitating contrasts between the dangers of various products, we are using the OMS/OPS[9] or EPA[10] toxicity classification system. The synthetic chemical pesticides, until now the most widely studied, are grouped into fourteen sets, each of which has *particular toxico-dynamic mechanisms* and characteristic effects upon human health (see annex N° 3). Some cause an interference in the cellular respiration (Benzoimidazoles; Botanicals such as Rotenone; Dinitroanilines; Pftalimides); others unchain a blockade of nerve impulse transmissions and impede the movement of Sodium and Potassium (Botanicals such as Piretro; Organo-chlorides; Piretroides); others cause an inhibition of the Cholinesterase (Organo-phosphorates; Carbamates); others cause a rupture of connections of oxidized [fosforilación] and an inhibition in the transport of electrons, as well as inhibiting some enzymes ([Benzonitrilos]); others mimick the actions of hormones, such as those related to growth (Phenoxyacetics); others inhibit the acetaldehyde [dehidrogenasa] ([Tiocarbamatos]); others inhibit the hepatic enzymes ([Triazoles]); finally, others alternate the metabolism of vitamins (such as the [Triazinas]) [Briggs

[8] The classic case is that of the difference of action of the non- selective systemic herbicide Glyphosate— whose fame grew through its use in air fumigations surrounding Plan Colombia—, and its combined use with low surfactants under the name of "Roundup" with multiple powers for damage.

[9] Those classified Ia (extremely dangerous) and Ib (highly dangerous) hold a red label; type II (moderate toxicicity) hold a yellow label; type III (light toxicicity) hold a blue label; and the type IV (if well used, have a minimal toxicity) hold a green label.

[10] The classification of toxicity used by the EPA (Environmental Protection Agency-USA) establishes 4 groups (I to IV, reducing in toxicity), according to the oral Lethal dose 50 approach; cutaneous DL50; DL50 for inhalation; the effect observable in the eyes (irreversible, or reversible corneal opacity, or irritation); effects upon skin (corrosive, moderate or light): Group I (< 50; < 200; 0.2; non-reversible corneal opacity in 7 days; corrosive); Group II (50-500; 200-2000; 0.2-2.0; reversible corneal opacity in 7 days, irritation; corrosive, irritation in 72 hours); Group III (500-5000; 2000-20000; 2.0; no corneal opacity, reversible irritation in 7 days; moderated in 72 hours); Group IV (>5000; > 2000; > 2.0; non-irritating; moderate or light in 72 hours).

1999]. Immediate dysfunctions are produced, by way of each of these physio-pathological routes, that go from light migraines, irritation, cutaneous sensitization and dizziness, nausea, shakes, muscular weakness, discoordination, irritation of the breathing tract; to asthmatic reactions, severe ataxia, convulsions, and deep breathing depression. They also cause *intermediate dysfunctions* that can be the product of their bio-accumulation in spite of low doses and apparently little potential for harm: dermatosis, cutaneous sensitization and [cloracné]; allergy and asthma; mutagenesis and cancer; theratogeny; miscarrages; hepatic and renal damages; inmunotoxicity; [hypofunction or damage of bone marrow, haematopoyetic hypofunction and anemia; cardiovascular damage; endocrine damage-- thyroid, especially the goiter--: embrio-toxicity and feto-toxicity; ovarian damage, sterility, testicular damage or oligospermia, impotence; insomnia, hallucinations; damage to cognitive functions, to cognitive motors, sensorial and affective, to the nervous system, loss of balance, ataxia, muscular weakness, loss of thevisual and auditory memory, etc; hipoacusia. Below we describe the types of toxico-dynamics [toxicodinamia] by apparatus.

But in the analysis of the toxicity of a product we ae not only interested in an analysis of its active ingredients, but also in the *vehicles* or *inert ingredients* of the pesticides, which can compose more than 50% of the product and which have been called “secret dangers” due to their danger and to the little attention and study that it is custmarily afforded to them. A listing of 20 inert ingredients of pesticides has just been published-- such as Carbonic Tetrachloride, Clorobenzene, Chloroform, Cresols, Etilbenzene, Metilbromide, Diclorobenzene, Phenol, Methylbenzene, Tricloroetileno, etc. - that produce proven effects, be they serious damage to the nervous system, to the hepatic or renal functions, hypoplastic anemia, cancer or genetic damage [Environmental Protection Bureau & Attorney General of New York 1996].

Regrettably the logic that governs pesticide use and that of other chemicals in agriculture, even in the more technified branches like floriculture, is the belief in an immediate economic advantage: “to use the cheapest thing and the aggressive effect of products synthetic chemicals to protect the plants”. Indeed, the notion has been spread that pesticides of high danger (red label) are irreplaceable in many instances and that their effect is cheaper and quicker. In great measure these notions are consequences of the propaganda of certain companies which market these agro-toxins, as are the “favorable” empirical results that agricultors obtain without the real opportunity to contrast them with ecological procedures, a consequence that would be understandable among poor farmers that suffer severe economic restrictions in their production, but not in highly profitable flower farms. It is believed therefore that in that way a better ‘cost: benefit’ relationship is achieved; but the evidence is showing the opposite because, firstly, considerable savings are realized when it is possible to implement a process of ecological control by way of integrated management;[11] but also, and what is more important, the use of more secure systems such a control combining integrated management with focussed applications of smaller quantity of chemicals-- even those of green and blue labels, and only a periodic use of products with extreme and high danger like nematicides--, cause, to the collective—as a group-- an enormous saving in: medical expenses of current problems like the presence of intoxication, but also future expenses derived from attention given to massive

[11] Several national flower companies have achieved a considerable savings by using alternative systems.

dysfunctions such as genetic disorders, Cancer or liver and renal damages, all which are incubated and develop under chronic forms and sub-clinical intoxication; also less decontamination expenses, of mitigation measures and control; less costs for the recovery of soils and biodiversity, loss of species, etc., that is to say, costs that are never counted when one calculates the costs/ benefits of agro-chemical use, because regrettably in our society this problem is thought through by privatizing earnings, while the expenses of contamination and the destructions produced are socialized.

A key aspect in health investigations in flower- producing areas is the knowledge of the *determinate processes of intoxication* for products bound up in the agro-industry. Intoxication stands out in this case, not because it is the only important effect upon health, because there are others that won't be directly analyzed in this publication, but because the work with toxins is a critical and typical process in this branch, and since it also crosses with the genesis of other afflictions.[12]

The situation described above causes a serious dilemma for those of us who work in the investigation and elaboration of proposals for prevention: it doesn't fit with a blind opposition in a branch of production that has generated employment and has invigorated the economy of the flower-producing regions, upon which thousands of families depend; but, on the other hand, it is not necessary to allow that, in the name of short term economic advantage, the health of inhabitants is mortgaged and injured, nor, for flower-growing, the same fate fall upon the natural resources of a territory that was previously dedicated to cattle raising and agriculture of foodstuffs.

For all the social, educational and scientific entities that are preoccupied with these topics, the central challenge is to build collectively, adding the special capacities of the distinct actors, a deep knowledge of the problem, to raise conscience on this issue and to generate proposals sustained by scientific foundations and by local experiences.

It is in this context that the arguments of this work should be located; to explain some of the disagreements in medical investigation; and to establish strategic lines for a development, scientific and community-controlled, of the production of cut flowers. These are matters in which professionals of health can play a fundamental role.

Debated dangers

The Myths of Safety Thresholds: The Example of Sulfur

In another work we have discussed more deeply the disagreement than exists around what are called "secure thresholds" in the exhibition to chemical products, and we

[12] Highlighted in relation to work in floriculture are respiratory, gastro-intestinal, genetic, dermatological, hepatic, renal and even mental processes whose pathogenesis, in good part, is mediated or promoted by intoxication; although logically there are aspects of this physiopathology or of other illnesses, such as muscular- skeletal dysfunctions, that have to do rather with other aspects of the logic of organization behind the productive processes and the division of labor in flowers, such as forced postures, or the passive or active muscular overload in the management of flower beds, or with the repetitive, monotonous, and tensely overloaded movements in post-harvest. There are problems like mental suffering that are likewise bound to the cyclical rhythms of high demand and the privations, bound to gender problems (the "triple loads" that female personnel suffer, for example, which we have described in other publications).

have highlighted the errors of the “paradigm of risk” when fixing supposedly acceptable levels of exhibition, or maximum quotas of tolerance, especially because they give the false premise that organisms, including human beings, can assimilate without problem a “certain grade or level of the substances” [Breilh 2001]. In the best of cases, this procedure can be indicative in punctual, located processes, with a short time of action, but the validity of that logic gets lost when we begin to judge dangerous processes of long and combined use. Accordingly, the principle of caution that consists in avoiding all practices that have destructive potentials, however small, is winning ground [Thornton 2000]. The biggest concern is that although toxicology and other sciences have advancedconsiderably, there is little known on the processes of bio-accumulation and bio-magnification, in which liposoluble products such organo-chlorides do not decrease.

In the production of cut flowers, we can take as a paradigmatic case the mentioned debate, that which rotates around the question of whether the sulfur is or is not dangerous. The use of sulfur sublimation as an effective fungicidal and acaricide resource can be an example that forces us to be more careful with measures of protection. Indeed wide sectors, including academics, maintain that there is no problem with their use, and even in practice the idea has spread that its employment in greenhouses can be made without greater caution. At the margin of the evident fact of their nauseous scent that affects the quality of life of neighboring residential areas, it is indispensable to take into consideration several arguments to emphasize the restrictions and cautions that should be applied for its use; a matter that takes us to meditate upon a preventitive politic very different from the one that has been spread.

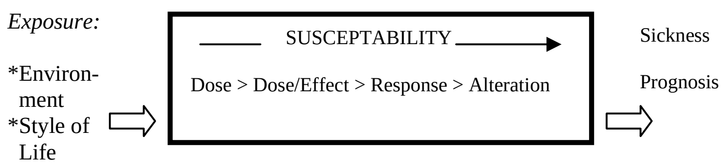
Sulfur is applied by means of electric sublimators—a very expensive technology when electricity bills are on the rise-- and by means of canyons. Especially the latter embodies special problems, not only for the personnel that runs along with the apparatus, disseminating large quantities along the beds, but also for the neighboring community. The sulfur in the WHO classification appears to be a product “that probably doesn't involve a sharp risk in its normal use” and corresponds to group IV (green label), in chart 5 of the said technical norms, and the column of observations recognized that it is irritating for the skin and the mucous membranes [WHO 2001]. But the matter doesn't end there; the very producers of sulfur, as in the case of the sulfur fertilizer named “Tiger 90CR,” dedicate a whole section of its manual to describing the dangers of the product (irritation of mucous and breathing tract if it is inhaled; mouth irritation, throat and stomach; it causes lesions in the digestive system; its contact causes cutaneous and eye irritation, it recommends not to clothes saturated with sulfur, and it indicates that workers should use clothing with a high neck, with long sleeves, gloves and pants with elasticized ankles. The producer also recognizes that there is not an established threshold. The same source indicates that the accidental combustion of sulfur causes its conversion to sulfur dioxide, with consequences such as soil acidification and dilution and, it would be necessary to imagine, with all the consequences to human health that investigations have discovered, like asthma, chronic bronchitis and lung cancer that is sustained by a plentiful literature on pathogenicity [Boezen et al, Marike 1999; Kogenivas et al 1999].

Epidemiology, Toxic-Kinetic and Toxic-Dynamic Processes

The conventional model of analysis in the epidemiology of intoxication suffers from two main problems: first, it doesn't differentiate between the categories of *determination* and *exposure*, or it treats them in reductionist terms[13]; and secondly, it doesn't interpret the mechanisms and exposition gradients adequately, as we shall see below.

Indeed, the conventional vision doesn't distinguish with clarity the intoxication as a grouping or as a wider problem (that embraces the processes of several domains and dimensions that were exposed in figure N°2), with its more specific dimensions (final events of exposition, absorption, toxic-kinetic and clinical processes).

Figure N° 3 Reductionist Notion of the "Black Box"



Within conventional perspectives, the problem is summed up in the establishment of empirical associations of these more specific, yet de-contextualized, events, a type of reduccionism which we see not only in the field of labor epidemiology in floriculture but also in classic approaches to occupational health, where notions like that of the "black box" are applied (see figure N°3) and which give focus only to the processes directly bound to what has been identified as the empirical or observable dimension of work (natural stratum of work). Pausing for a moment on this important problem, indeed we should clarify that from the new vision that we are proposing, it is necessary to know that the three constituent elements of all working process—the *labor force*; the *mediums* and the *object* upon which one works-- should not only be analyzed in their natural or physical dimensions (that is to say, as corporal-mental processes of the work force; as technological aspects of the mediums; and as physical, chemical characters or mechanics of the objects), because this would be equivalent to staying trapped in the empirical or apparent dimensions. It is necessity to think that the generative plane, or the determination, of these processes, assuming that, behind the operation of labor and of the organization of their work, there are inequitable relationships, that beind the technological organization of the processes there are relationships of power that determine them, and that behind the objects and their form of use are also social relationships. That whole totality is known as the social stratum of work and that explains what can be observed in the so-called "black box".

According to conventionalperspectives, our task would be reduced to "illuminating the internal elements of the black box" and to showing its relationship with loose variables, equally "independent" (of exposure) ones, as dependent (of the illness) ones and to only act upon these direct factors; it is as if the modalities of exposure, the conditions of the "black box" and the consequences in mortality were pathogenic events in themselves, without the determination of a logic of production, with its organization of the processes, with the relationships of power that are given in the

[13] In investigations, *reductionism* implies reducing the study from the reality to that of its simpler or more elementary components, robbing them of their relationships or integral concatenations.

productive process and that determine the way in which the critical processes of exposure are distributed and operate, as well as of imposition of some permanent destructive forms. To cover these aspects we need a focus, an alternative interpretation scheme, some elements of which we discuss below.

General Epidemiological Determination Phase

The epidemiological *determination* of intoxication demands that we see epidemiological facts as constituent of a global reality, in which typical forms are given of events that tend to be regular or stable, while lasting through a single historical condition. To understand the epidemiological events, we always have to study them in relation to the macro-structural conditions of an entire region/ line of production; and the consequent *modes of life* of groups fully characterized and differentiated that put that social reality in motion (social classes, ethnic groups, gender differences and even generations), from which true epidemic profiles can be derived. Only by way of these modes of life and profiles can we study and hope to understand the *styles of life* of the quotidian experiences of families and people, upon whom settle *critical processes of exhibition*[14], more specific than those Betancourt has analyzed as "exhibition events" [Betancourt 2001]. "Modes of life," "styles of life" and "critical processes of exhibition" are reproduced by structural conditionings and are the generative or decisive mechanisms of what become the forms of absorption, action grades and toxic-kinetic and toxic-dynamic mechanisms, forming truely characteristic *intoxication profiles* of each social group considered.

Although the intoxication profiles vary considerably among different social classes, and even according to gender and ethno-cultural differences, the truth is that investigation has begun to demonstrate that in floriculture without ecological norms and without labor protection, exposure is very high and for the case of Mexico, the average hours/ year of exposure reached 2 to 5 times higher that in many agricultural activities. In spite of the quantity and pesticide mixtures used, no cases of sharp intoxication were detected, surely because products of moderate toxicity were used, all of which forces us to probe deeper into the problem [León 1997].

The Intoxication is Probably Projected to Flower Consumers

The problem of the ecological and human effects of the intensive use of pesticides in the production of flowers is not limited in its impact upon the labor force and immediate ecosystems; rather, there are indications that contaminated flowers can vehiculize the impacts to the florists and likely to flower consumers. In a study carried out by the Department of Pesticide Regulation of the EPA in California, it was determined, by means of studies with liquid chromatography and gases, that residuals of toxic pesticides exist in the hands of florists, particularly fungicides such as [Clorotalonil], [Vinclozolin], and [Captan], found in 95%, 70% and 67%, respectively, of the samples. This study did not demonstrate the relationship among these results and the practices of flower handling, nor the experience or the protection measures used by the florists [Saiz, Steven et al 1997].

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[14] We have already said that *critical process* is an element of the epidemiological profile that stands out as an object for investigation and transformation in a study; it implies a demand for intervention. A critical process of exposure is a characteristic exposure event, real in its capacity to favor contact and absorption, and susceptible to being recognized and modified by organized intervention.

This type of discovery should summon the attention of civil society from another angle, since it is not a problem of the impacts that workers suffer directly in floriculture, nor only of the progressive impacts in the deterioration of nature, but rather it is necessary to also analyze the problem of the impacts carried along by the contaminated flower to the buyers that, although it is not a problem of great magnitude, cannot be ignored as a matter of interest in prevention.

All said, in our investigations we are obliged to study several dimensions of the problem, equally the determinate processes as the intoxication profiles and of derived health; in other words, it is indispensable to differentiate conventional visions of intoxication, seen as an individual-clinical problem, from the epidemiological vision of intoxication, which is much more than simply demonstrating the significant association of a number of independent variables with the empirical indicators of toxicity.

Toxic Kinetic Phase

There are three *routes of absorption* for potentially toxic substances: inhalation, ingestion and dermal. By *inhalation*, chemicals cross the respiratory tracts, reach the lungs and advance toward the blood and lymphatic system; from there they can return to the lungs and be eliminated; or they can pass to the compartment of subcellular fluids and, depending on their lipo-solubility, can pass on to bio-accumulate in different organs (fatty tissue, hair, fingernails, skin, bones, other organs and subcutaneous cellular tissue); they can also pass to such secretory structures as the sweating and mammary glands; or finally they can be excreted by urinary routes. Chemical *ingestion* begins in the cells of the gastro-intestinal tract and from there the chemicals can pass to the feces or enter into the intestinal-liver circulation and the liver, where the residuals and conjugated materials can pass to the biliary juice and the digestive tract for its elimination. Finally, in the *entrance by dermal penetration*, these elements can pass into circulation and from there to the previously indicated routes, or go on to the fatty tissue.

The route of absorption also contributes to the severity of the effects (lung inhalation being the least resistant and quickest road, gastro-intestinal ingestion an intermediate road, and the dermal route being the slowest and most protected). Once absorbed by the human organism, the chemicals enter into circulation and the toxic-kinetic phase. Those that are absorbed by the stomach or the intestine enter the hepatic portal system and are taken to the liver where they are subjected to a process of *bio-transformation* that almost always involves a *detoxification*, by means of phase “I” reactions that are catalyzed by enzymes of the endoplasmatic reticulae–of oxidation, reduction, hydrolysis, dealcalinization, desamination, dehalogenization, formation and rupture of rings - and/or a phase II which involves the conjugation of covalent connections with the absorbed chemicals or the products of phase I—by means of compounds such as glutathione, glucoronic acid or amino-acids. But bio-transformation is not always a healthy process, since a restitution of *bio-toxification* can occur around the production of aggressive agents of nucleic acids or nuclear proteins, which are mutagenic or carcinogenic or, in turn, nitrates generated by bacterias that generate metahemoglobin and the rising anoxia and death of the tissues [Duffus 2001].

Those conjugated are generally converted into more hidrosoluble products and can be excreted. The liposoluble chemical should be bio-transformed into excretables forms and those that cannot be tend to bio-accumulate in tissues and in milk, where they reside until being expelled to exercise their effects, by metabolic conditions or stress.

The final result of the toxic-kinetic phase is the elimination or detoxification of the chemicals, or the production of an initiator of toxicity with which the following phase begins.

Toxic-Dynamic Phase

Once the toxic initiators to enter their operations and begin a reaction in the points of impact or shock organs, the toxic-dynamic phase begins and a struggle in the phenotype begins among the specific processes of toxicity in different sectors of the organism and the defense processes.

The intoxication process can be *accute* when one receives a high dose of the product, concentrated on a single impact that produces a manifested effect; while it is of *low intensity* when it is received in low doses, if prolonged a long time, in such a way that, though they don't end up causing ostensible effects, generate a hidden physio-pathological process, due to the bio-accumulation of the small effects that can destroy organs such as the liver, kidneys, bone marrow, endocrine glands and the gonads, or can deteriorate the nervous system over a long period, or can act as promoters or detonators toward a process of Cancer. According to the *mechanism of exhibition*, the intoxications can be classified in the following way: *periodic exposure* (of casual and not related to a mode of life of the group and/or family way of life); *chronic exposure* (generally related to a group's mode of life, be it their working or consumption pattern, that is to say to a family or personal style of daily activity; that is to say, it is implied to be a quotidian experience); and finally, *permanent exposure* (that is preferably called "imposition," which implies continuity or permanency to the of actuation of the destructive process) [Breilh 2001].

The toxic-dynamic distribution according to the chemical nature of the product and its roads of absorption determines where the toxicity processes begin. What has been demonstrated is a florid pathology in the zones where pesticides are used profusely in agriculture, such as that shown by a national system of pesticide monitoring in Egypt that found very high percentages of affectation among mix preparators and fumigators, confirmed by combination of diagnostic instruments: periferal neuritis (40%); psychiatric manifestations (40%); electroencephalographic changes (25%); hepato-renal dysfunction (80%); hepatitis (29%); and chromosomic aberrations. Simultaneously, residuals of pesticides were detected in samples of cheese, butter, yogourt, and powdered milk of the studied region [Amr 1999].

Neurotoxicity and Cholinesterase

Knowledge of the structure and operation of the nervous system is fundamental for an understanding of neurotoxicity and its neuropsychological manifestations. It is basic to recognize that the nervous system includes somatic structures that control the grooved muscles, voluntary and visceral, that operate in the control of internal organs.

It is also necessary to distinguish among structures derived from the the embryonic neural axis (spinal cord, cerebral shaft, cerebellum and brain) and those which are periferal, formed by motor neurons, sensorial and autonomous, located outside the central system (spinal nerves, cranial nerves, autonomous nerves). The autonomous nervous system with its sympatic and para-sympatic components impacts on the involuntary functions. Regarding the neuro-endochrine system, it is important to clarify that although a distinction was once made between hormones and neurotransmitters, with the discovery that classic neurotransmitters, such as the dopamine, can act as hormones, this previous distinction is losing force. To understand this, and simply from an anatomical point of view, the derivative hormones of nerve cells are being called neurohormones, yet in fact the nervous system is functionally a neurosecretor system. Until the 1950s it was thought that the endocrine system was independently regulated by the pituitary gland; today it is known that the endocrine system is regulated by the central nervous system equally for endocrine functions. At the molecular level it has been established that neurotoxins act in neurotransmission and their effect depends on the site in which they act, their chemical receptors, of if they will impact upon the blockage, inhibition or stimulus of neurotransmission, or if they will alter the finalization or removal of the neurotransmittor. Acetylcholine, for example, is the main neurotransmittor of the symaptic and parasympatic autonomous system that is found equally in sympatic and parasympatic synapses, as in the neuromuscular and neurosecretion unions. It is known that acetylcholine has nicotine and muscarine receptors, as activated by nicotine or muscarine respectively. Organophosphorous and carbamate pesticides cause the reduction of an enzyme— acetilcholinesterase-- that effects the hydrolysis of acetylcholine [Valciukas 1991]. There are two types of cholinesterase, the real one, [eritrocitaria], specifically type "e," that is exclusively found in the neurons, [ganglionares] synapsis of the neuromuscular structure and in the erythrocytes; and the pseudo-cholinesterase, unspecified, plasmatic, or type "s" that is present in almost all the tissues and in the plasma, but small concentrations in the central and peripheral nervous system. When working a population with chronic exhibition to low doses, it is preferable to work with [eritrocitaria] since it has a function similar to the [isoenzima] of the nervous system, the long half life of the red cells, and because it is affected less by physiological changes, illnesses and medications [Carmona-Fonseca & Henao & Garcés 2000].

We have already commented on the neurotoxic processes that cause different chemical groups of pesticides, in their two forms, accute and chronic. The toxico-dynamic processes that produce a nervous physio-pathology, by means of the destruction of the functional tissue, rupture of connections, inhibition of electron transmission, inhibition of Sodium and Potassium conduction, enzymatic inhibition, alteration of the production of other neurotransmittors like noradrenaline, which can generate a deterioration of the functional tissue, or a blockage of nerve impulses, or an excessive accumulation of acetylcholine, according to each case.

The organophosphoros and carbamates produce an accute syndrome of a [colinérgico] type (for the irreversible inhibition of the cholinesterase enzyme), manifested by depression of the level of consciousness, miosis, bradycardia, diarrhea, abdominal pain and an augment of resperatory secretions. Chronic toxicity compromises the outlying nervous system, even generating a senso-motory polyneuropathy that persists, months after suspendingexposition, and ending up producing sequels in some patients. The carbamates also produce a [colinérgico] syndrome, but of much smaller intensity and which usually follows an auto-limited course, in which complete recovery takes place after some days. The characteristic symptoms of intoxication by organochloride compounds (such asDDT) are hiperexcitability, tremors and convulsions, in extreme cases.

Organiphosphorous pesticides are still used and affect the enzymatic hydrolysis of the acetylcholine neurotransmittor by means of the decrease ofcholinesterase, with a consequent [colinérgica] intoxication.

The reduction of [eritrocitaria] acetylcholine (AchE)—adjusting their value for hemoglobin -- has been considered conventionally as a valid and reliable indicator of exposure to organophosphorous and carbamate, which are frequently used in floriculture. Regrettably, the excessive trust in this indicator has not allowed us to know the true prevalence of and intoxication incidence for pesticides in our country, because though they are accumulating evidences, a disagreement has appeared over the use of [AchE]. The absence of registration or low prevalence of positive cases of [AchE] in the files of medical services that attend flower workers, as well as the discoveries of studies realized in the country [Bossano & Oviedo & Santacruz 1998; CEAS 1998], question the capacity or sensibility of [AchE] to detect all the cases of intoxication. It seems to be that the said indicator is not adequate for the detection of chronic processes, of low intensity, but not for those less destructive over greater time; whcih was motivated CEAS to work in the investigation of a more sensitive [tamizaje] system (“screening”) that is more specific [Breilh 2001b].

We should aim to complement the use of [AchE] with other indicators, simple and cheap, that allow the early detection of physiopathological and sub-clinical dysfunctions. In fact the reduction of [AchE] has allowed the realization of interesting studies, such as:..... [CEAS 1998] a contrasting prevalence of detectable toxicity by [AchE] between agricultural and floriculture workers in the Northern Sierra of Ecuador [Bossano & Oviedo & Santacruz 1998]; the study of values of reference or basal of sanguine cholinesterase activity in labor population not exposed to pesticides [Carmona-Fonseca & Henao & Garcés 2000]; correlation of intoxication with levels of education among farmers from Brazil [Oliveira Silva et al 2001].
Renal toxicity is characterized by the destruction of tubular epithelium and the consequent deterioration of the capacity for renal filtration. Hepatotoxicity is characterized by the deterioration of the [hepatocitos] and the reduction of levels of [glicógeno].

Investigation into the impact of organophosphorous pesticides in the renal [parénquima] has been conducted by measuring the elevation of activity of enzymes like alkaline [fosfatasa], [N-acetil] [glucosamidasa]; lactic [dehidrogensasa]; alanine amino [transferasa]; [aspartate] [aminotransferasa]; and [arginasa] in the urine of workers that work in the production of said pesticides [Kossman 1997].

[Hematopoyética] Hypofuntion and pesticides

The bone marrow is in charge of the production of red, white globules and platelets. Several dysfunctions affect the [hematopoyética] function and from there occur different types of anemia.[15]

One of the varieties of anemia that is conventionally called “aplastic” and that is preferably called *hypoplastic* because it is characterized by a decrease of the [hematopoyéticas] cells and the consequent reduction of red globules, platelets and [leucopenia][16]; it is associated with the impact of several agro-chemicals, including pesticides and [benzenos] (see annex N° 3).

In the most important case studies and controls related to “aplastic” anemia carried out in Thailand it was possible to demonstrate that a clear association exists between this anemia and exposure to agricultural pesticides, and that this relationship depends on socioeconomic group, being more stretched in classes in greater deterioration [Issaragrisil 1999]. In another similar study in China, important relative risk was demonstrated equally by exposure to pesticides [Zhongguo & Ke & Yuan 1992].

Current evidence point to the necessity of looking with greater care at the numerous cases of anemia that are found among the labor force in flower farms, which have been interpreted, without previous investigation, as [ferropriva] anemia or of lack of nutritional iron.

No consent exists in this respect, but it is our suspicion that many cases showing a reduction of red globules, provided they are [normocrómicos] and [normocíticos], coexist with normal values of [ferritina sérica], and low levels of platelets and leukocytes, which could constitute an early sign of toxicity. [Ferritina sérica] has been recognized as the best indicator of [ferropriva] anemia[17] [Guyatt & Oxman & Ali 1992].

The literature from Latin American also reports a mielotóxic] impact of pesticides [Sinco et al 1984; Jiménez et al 1987; Kusminsky et al 1988]. [*Hematológica] toxicity* is expressed by a reduction of the glutathione [reductasa] [eritrocitaria], in the reduction of red globules, of hemoglobin and its half corpuscular volume, as well as the [leucopenia] and thrombocytopenia. A virtual absence of the [hematopoyéticas] cells takes place (“stem cells”) apparently mediated by activated T cells and [citokinas]. Benzene also acts to produce intermediate metabolites that are toxic for DNA and proteins [Capurro 2001].

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[15] *Ferropriva* anemia or by nutritional iron deficiency; *megaloblástica* anemia for vitimin deficiency; anemia for *thyroid dysfunction*; hemolytic anemia for the destruction of red globules; *mielopsítica* anemia for leukemia and the substitution of hematopoyéticas cells with cancerous cells; anemia for *falciform cells*, for congenital structural defects; anemia of *chronic illnesses*, for inhibition of eritropoyetina production on the part of the immune system; *sideroblástica* anemia when there has been a normal level of iron and there is a defect in hemoglobin production; and *“aplastic”* anemia when there is a destruction, generally toxic, of the marrow.

[16] It is necessary to distinguish aplastic or hypoplastic anemia, in which a decrease of the hematopoyéticas cells exists, from mielodisplástico syndrome that was earlier erroneously called pre-leukemia, and that in which exists a congested marrow of deformed cells and which stops producing healthy cells.

[17] The ferritina.

Respiratory impact

At the respiratory level, toxicity causes damage in the ciliary structures, accute emphysema, [cianosis] and inter-alveolar hemorrhages. There have been reports of serious tracheal lesions due to the [Paraquat] herbicide that causes the liberation of radical peroxides and [proteolíticas] enzymes that destroy the lung epithelium and can even cause fibrosis [Venkatesan 2000; Ruiz-Bailen & Serrano & Ramos 2001]. Physio-pathological studies have demonstrated that [Parathion] produces serious modifications of the mechanical [ventilatoria] and deteriorates the responses of the [ventilatorios] mechanisms. It causes an increase in the index of lung resistance; an augment of the content of water in the [parénquima]; a decreas in the responses of neurotransmittors like acetylcholine and histamine, and an inhibition of the activity of cytochrome (P450) [Segura 1999]. The ingestion of [Diquat], similar to [Paraquat] causes esophagitis, mucositis and epiglotitis, before producing an accute renal flaw. Atmospheric pollution with pesticides has also been related to the genesis of asthma [Koren & O' Nelly 1998]. The metabolic capacity of the cells of the [olfatorio] and bronchial tissues contribute to their susceptibility to the inhaled toxics. The principal enzymes that metabolize toxins at those levels are the [monooxidasas] and [carboxilesterasas] that contain cytochrome [P450] and [flavina] [Dahl & Gerde 1994].

Renal Deterioration

The impact of pesticides in the urinary system is evident. A relationship has been demonstrated between the insecticide [Ensulfan] and the production of sharp tubular necrosis and consequent renal inadequacy [Lo 1995]. But it is also now known that the prevalence of inflammatory infectious lesions of the kidneys is higher in population groups exposed to pesticides (7.9-13.4% with respect to 1.5% in the controls) [Allazov 1994]. [Endosulfan] has caused accute interstitial [nefritis] [Segasothy 1992]. Intense exposure to pesticides is associated with the appearance of glomerulonephritis [Polla 1983].

The tracer most used used to assess impacts to renal functions is the [sérica] creatinine and its elevation in the event of chronic or accute progressive renal inadequacy, or renal flaw. There are limitations in the use of [sérica] creatinine as a biotracer of these problems, since it is equivalent to investigating renal toxicity with lead. Taking into account that this metal affects [glomerular] and tubular functions, it has been established that the most reliable tracer of [glomerular] functions is the cystatin-C concentration, since, contrary to [sérica] creatinine, it functions independent of sex, age, stature and corporal composition [Staessen 2001]. However, it continues to be used as a useful and sensitive test, so much so that the Canadian Society of Nephrology recommends it as an instrument of [tamizaje] of renal inadequacy [Mendelssohn 1999], although it is true that several studies suggest the possibility of the complementary use of tracers more sensitive to early renal dysfunction such as the enzymes: [alanin aminopeptidasa] (AAP); N-acetil-beta-D-glucosamidasa ([NAG]); [proteina ligadora de retinol] (PLR); albumin in urine; and [beta(2)-microglobulina] (beta-2-M-S) and creatinine in serum [[Verplanke] 2000].

[Hepatoxicidad]

It has already been explained that a national monitoring of fumigators and [formuladores] confirmed the presence of hepatic dysfunction in 80% of the sample group [Amr 1999]; that is to say, the liver is an organ of important impact.

In the case of the organochlorides, it has been demonstrated that their physiopathological process depends on their stability, that is to say their liposolubility, with a potent inhibiting action of the activity of the ATP-handles, related with the oxidizing phosphorilization, blocking cellular respiration. Once transforming [into, in the??] liver to hidrosoluable metabolites and excreted, some of those metabolites return to be equally toxic for the liver and kidney [Aguilar 2000]. In experimental studies with [Paraquat], massive hepatic necrosis was found. Further, the invasive [hepatocelular] carcinoma is also related to the promoter effects of pesticides [Brodanova 1997]. Death has been reported by [fulminante] hepatitis in an agricultor who washed a receptacle with [diclorohidrin] [Shiosaki 1994]. In another context, phototoxic contact [dermatitis] and hepatitis have been reported related to the [percutánea] absorption of [Paraquat] [Vilaplana J, Azon A, Romaguera C, Lecha 1993]

The hepatic enzymes that are used as tracers in toxicity studies are of two types: the [transaminasas] ([SGOT] and [SGPT]), conventionally used for clinical diagnosis and as a tracer of toxicity in some epidemiological surveys; and enzymes with greater detection capacity used in most tests and current investigations, such as [alanino-transferasa] ([ALAT]); [aspartate] amino [transferasa] ([ASAT]); gamma [glutamil] [transpeptidasa] ([GGT]); alkaline [fosfatasa] ([FAL]); [bilirrubina] total ([BILT]) in serum [Kossman & Wartalska 1984; Verplanke 2000; Court et al 2001].

The [transaminasas] ([GOT], glutamic oxalacetic and GPT or glutamic pyroacemic) are enzymes that catalyze the transfer of amino groups of amino acids to [cetoácidos]. Their greatest concentration takes place in the liver and for that reason the increase of its level in plasm reflects a degree of destruction of the hepatic cells. The [GOT] not only takes place in the liver but in other tissues such as the heart, skeletal and renal muscle, but the greater part is generated in liver. As for its value as a tracer of hepatic intoxication, contradictory evidences are found in the scientific literature. Some experimental designs have verified their elevation in exposed litters to bigger doses and a state of chronic intoxication for pesticides [Ballet et al 1999]; in others they hardly found any fluctuations, apparently not significant, in the curves of [SGOT] and [SGPT] [Sawas 1998].

Problems in the Skin

We have already indicated that the skin is a route of absorption, as well as an organ of impact. In agricultural work there are multiple tasks that allow for contact of pesticides with skin, equally in aspersion or fumigation, as when mixing, cleaning equipment, handling vegetables, recipients or polluted instruments. In the case of work in floriculture, although it is usually thought that fumigation personnel is the most exposed group, it seems to be that in farms where this personnel is well protected, other areas can be those where, not having the reinforcement of protective measured, indexes of greater contact can be found. The tasks of cultivation tasks, post-harvest and those of maintenance personnel and auxiliary services that awaken less fear or concern are many times carried out without appropriate protection and form a fertile terrain for chronic intoxication of low intensity.

If we leave to one side dermal absorption as a route for intoxication and we become preoccupied with the occupational problem that pesticides and their inert vehicles cause in the skin, we find other problems, like it is the vast totality of [dermatosis]. Under this grouping of entities, the most frequent problem is that of contact [dermatitis], equally in allergic form as an irritatant. Likewise, some pesticides and/or inert compounds increase the cutaneous photosensitivity and cause photo-toxic reactions. It is interesting to note that although a pesticide may have been pulled from the market, sensitivity to the product can last for years and possibly reappear by means of a crossed reaction with a new pesticide with a structure related to the initial creator of sensitivity. Apart from the above-mentioned problems, pesticides are related to other less frequent cutaneous problems, such as: urticaria (vascular edema located in the superior dermis); multiform erythema (erythematic eruption with characteristic lesions in form of bull's eye); [dermatosis] of [Ashy] (erythema [discrómico] like stains on people with dark complexion); [parakeratosis] [variegata] (atrophies cutaneous with discolorations); cutaneous [porfiria] ([hiperpigmentación], facial [hirsutismo], loss of hair and [engrosamiento] of the skin); [cloracné] (dysfunction of [pilosebáceas] glands, similar to common acne); [hiperpigmentaciones]; loss of hair; [ungeal] dystrophy; and cancer of the skin (melanomas, labial cancer, [neoplasias] non [mielocíticas] and of the penis) [Spiewac 2001].

Multiple Genotoxicity

Toxic agents affect the DNA in a direct way or adhering to them like "[aductos]" that interfere with their function. Once arriving at the cell and nucleus, they cause [genómica] instability, producing structural alterations, losses of continuity, and losses of chromosomes, of which can result: a mutation, which can possibly advance to a cancer; or a repair by means of genetic [polimerasas] that, in turn, can be satisfactory and restore the original structure, or result in programmed cellular death ([apoptosis]).

From the point of view of epedimiology, it is especially important to emphasize that, equally for the *intoxication profiles* as for the *profiles of response and protection*, -- of which we spoke previously --, they are characteristic of the population groups with different modes of life. In the case of geontoxic processes, this contradictory character operates as well, and there is great variation from one social class to another, from one ethnic group to another, etc., in terms of the intoxication forms and their aggressiveness, as well as capacity for response, defense or protection. First, destructive processes and, second, protective measures, are made possible within the modes and styles of life characteristic of each group and, in their biological dimension, include the confrontation between the power of the toxins to generate [genómica] uncertainty and chromosomal dysfunctions, and the reparative capacity of the genes that also differs from one social group to the next.[18]

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[18] Cesar Paz y Miño, Director of the "Laboratory of Molecular Genetics and Citogenética" of PUCE sustains that there is relationship between reparative capacity and ethnic condition, and that Afro-Ecuadorians and indigenous peoples— the polimorphism of the genes affords different reactivities –. We believe that this observation is very important but we would insist that, in agreement with

The genetic impacts of pesticides and inert substances are multiple. They cause [mutagénesis] (alteration of the genetic material of a single gene, or in the number or structure of the chromosomes, possibly advancing later to teratogenesis or [neoplasia]); [carcinogénesis] (induction of abnormal [neoplásico] growth, disordered in a tissue or organ); and teratogenesis (induction of anomalies in the product of the gestation that occurs when the toxin crosses the [placentaria] barrier) [Albert 1990].

The above confirms that [citogenéticos] studies and their tracers can be used as instruments of genotoxicity monitoring, early detection and prediction. To this day the most common tests are unspecific and of two types: chromosomal studies that can be made in sanguine cells and take more or less 15 days per case; or studies of electrophoresis of the nucleus of unique cells—lymphocytes or exfoliative--, like the so-called *comet assay* that appeared recently as an alternative instrument for monitoring toxic damage to the DNA. The comet test is an in vitro examination of the capacity for damage to the DNA of a certain product, using [microgel] electrophoresis in lone cells—generally lymphocytes—whose uses in genotoxic monitoring has been generalized with satisfactory results [Guo 1999; Gluck et al 2000; Monarca 2001; Hartmann et al 2001]. Although some authors call our attention to the possibility that the images of [apoptóticas] cells can generate false positives [Choucroun 2001], some point out the necessity to control the false positives with/ by [citotoxicidad], making sure that the maximum concentration of the analyzed substance produces a viability grater than 75% [Henderson et al 1998], and others who would recommend its reinforcement or validation with a test of the [micronúcleo] [Hartmann et al 2001]. These types of limitations and the necessity to control variable agitators—age, exposure to polluted air, diet, exercise type, gender, [intercurrente] infection, exposure to Radon, smoking habits— according to other authors, should not discourage us from their use, since the negative results are broadly overcome by the positive results, and the simplicity, ease, dependability and low cost of the test thoroughly recommends their use[19] [Moller et al 2000]. Furthermore, it has even been used to observe the toxic impact in mamma cancer, subjecting to this test equally the obtained residuals of polluted maternal milk, as the exfoliative cells of the same [Martin 1999]. In the test, a qualitative appreciation of the damage is not only made, but further, by observing the line of the comet, the damage in DNA is analyzed using three parameters: longitude of the line; percentage of DNA in the line; moment of the line [Kopjar & Garaj-Vrhovac 2001].

Looking now at the topic of genotoxicity in floriculture, it is necessary to analyze some epidemiological discoveries. An investigation of the [mutagénico] impact of pesticides in floriculture workers and a control group was done in Mexico. Faced with indications of problems in this labor force and a verification of the presence of [neoplasias]100 times higher in populations neighboring flower-growing greenhouses, several studies began to look at the degrees of [genómica] uncertainty and chromosomal alterations (by means of analysis in sanguine lymphocytes of exchanges

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consistent epidemiological discoveries of social contrasts, that reparative differentiation must also be found among social classes with deeply different histories and qualities of life.

[19] The technique employed in Quito by the Laboratory of Molecular Genetics and Citogenética distinguishes qualitative types from “A,” no deformation of the nucleus, to “E,” with maximum nuclear deformation as if it was a comet. The “tail” of the comet can be measured in microns, understood that greater deformation is equal to greater damage.

of [cromátides] hermanas in [metafase][20]-- [ICH] --; [mitótico] index and cellular replication; and analysis of micronucleos of samples of oral mucous). It could be demonstrated that, in the kinetic tests of cellular proliferation, the indexes of the group of flower workers were significantly higher, and that these operatives showed chromosomal damage [León 1997]. In Ecuador a similar design contrasted 41 workers of flowers and 41 controls, analyzing 100 metaphases per individual to discover numeric alterations and ruptures of the chromosomes. The percentage of chromosomal fragility in the group of flower workers was bigger than in that of the controls: chromosomes were 50 times more altered; and the frequency of chromosomic aberrations was 30 times greater [Paz y Miño 2000].

Reproductive health and pesticides

Reproductive health is the capacity of a healthy woman to procreate healthy descendants with healthy men, as well as the capacity of her descendants to do the same. Reproductive health is one of the processes most vulnerable to toxins, and for that reason it has been said that the woman's health and that of her children is one of the best indicators of ecological status. The persistent organic pollutants are carbon compounds with great persistence and capacity for bio-accumulation. A series of these products generates diverse impacts in reproductive health: hormonal alterations, by means of a mimetization (?mimicking?) or blockade of the action of estrogens and testosterone; in this way, they can cause hypofunctions and anomalies in the reproductive and endocrine apparatus; deterioration of the adrenal glands; and since they have the capacity to cross the [placentaria] barrier and to contaminate the maternal milk, they can thus cause deterioration in the formation and retardation of cerebral growth; in women they can generate endometriosis, with the formation of endometrial tissue outside of the uterus, as nodules or tumors [Ohanjanyan 1999]. Several pesticides causes degenerative changes in the [seminífero] epithelium, testicular atrophies, ovarian cysts and other histological changes in the reproductive organs.

In the [trasfondo] of many of the previous processes and their intimate relationship with the capacity for response against the destructive processes and intoxication, it is the impact of the chemicals on the immune system or *immunological toxicity* that is expressed in considerable reduction of immunoglobulines G and M and gammaglobulines, whose decrease causes the inability of organisms to unchain their protective and detoxifying resources.

SOME ASPECTS OF INTEGRAL MONITORING

The goal of a “just and ecological flower” as we see it, requires that we who carry out academic or technical work in social, health or environmental fields, realize a strategy of change in three dimensions: investigation, monitoring and certification.

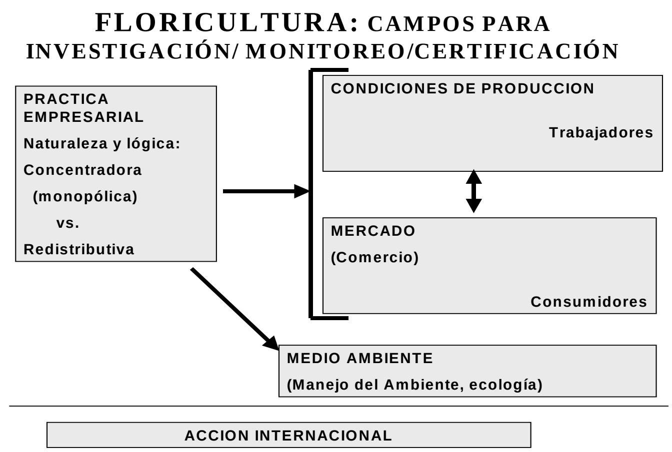
A lot of investigation is needed to perfect our knowledge of the destructive processes (to counteract them) and healthy processes (to promote them). But what is also required is the establishment of a system of monitoring the processes, with the

[20] Mitosis or cellular reproduction that is realized in all cells, except those of the gonads, have stages: prophase; metaphase; anaphase and telophase.

purpose of permanently evaluating their tendencies. And finally, it is necessary to develop a certification process that values the social control put upon floricultural activities.

But an integral approach to the *investigation/monitoring/certification* of floriculture activities has to take into account all dimensions of the problem: equally those that affect the workers inside the farms as the consumers individually, it must take on the totality of the problem. That is to say, even the market conditions that impose patterns of quality and production rhythms have to be known and monitored; and the business and management practices that with their modes and styles determine the logic of flower producing activities in their totality, national and internationally (see figure N° 4) [Breilh 2000].

[N°] figures 4



From an epidemiological point of view, we have to struggle so that the *product* is safe for consumers, not only that the market quality and *processes* have to be healthy, first inside the famrs—in such a way that the working process that affect the workers are healthy, secure and equitable--, and in such a way that the *ecological relationships* inside the farms are equally healthy and secure; but it is also our duty to struggle so that the world of *managerial practices* is sustainable, to avoid the possibility that monopolistic business organization and corruption destroy the derivative human benefits from the production of flowers. Finally, a line of integral intervention cannot lack *international action* that allows for the growth and promotion of the combined efforts of defense of just and secure working conditions, that contributes to the marketing of fair flowers for consumers the world over and that protects the justness and the sustainability of the production and distribution system in its totality.

Investigation provides knowledge to elaborate *technical norms of security and health*; *monitoring* makes the *codes* viable and allows for a control of the fulfillment of social and ecological standards; and *certification* proposes the possibility for a socially effective control over the processes. Ideally, an integral plan for fair and ecological flowers would then have to articulate efforts in these three interdependent elements, and this is not feasible without the commited participation of several key actors: companies with a social and ecological spirit; unions and the organizations of involved workers; the communities of the flower producing regions; officials of the State entities who hold responsibilities for the protection of the environment and health; social security; the social movements dedicated to the struggle for ethno-national and gender equity, in short, it is not feasible to organize a great regional or national project for a just and ecological flower if a grand system of social participation and control is not activated. But further, we should not close ourselves off within the realm of national action, because a lot can also be achieved toward the push for fair and ecological production with the gathering of international consumers' organizations, experts and academic centers that are interested in building a world of justness and sustainability.

Norms, Codes and Standards for A Just and Ecological Flower

At the end of the 1980s and early 1990s an *international campaign of flowers* was organized, impelled by organizations of America and Europe—especially unions and NGOs of Germany and Holland—concerned with the necessity of setting standards of social and environmental protection in the production of cut flowers. That effort culminated in 1998 with the implementation of the *International Code of Conduct*[21] under the Program of the green seal ("Flower Label") for flowers. The initial version has been perfected toward a more solid code that permits the qualification of flower companies that work under a fairer system of social and environmental protection [FLP 1999]. Once a farm owner applies for the seal, he is given the requirements and then a checklist is applied by an international inspection team, with items based on the international code; after some time, a national technical group makes a reinspection by means of the checklist and, finally, the company receives its qualification if it proves to have satisfactory conditions.

Reactions of the companies to this effort were slow in the beginning, and were results, in many cases, of more a pragmatic vision than responsible attitude, but in all any case, the group of companies holding the seal—around 15% in the Ecuadorian case—have passed on to become an example for the rest not only in the adoption of more humane and ecological standards, but also in the advantages and saving achieved by a more rational industrial operation. Without a doubt, the conditions of the world market will be increasingly guided toward the production of a just and ecological flower—a tendency that is not only observed in flowers but also in other lines of agro-export—,and the growing conscience of consumers, like the Europeans, and the international programs that form the human side of globalization, will produce the effect that soon flowers that do not fulfill these standards will not be accepted in the market. At present there are several seals that have been expanded with similar objectives.[22]

What one has now is the product of a prolongued social and unionized fight, but so that we may consolidate the achievements already reached, that have already begun to benefit thousands of American, European and African workers, as well as to

[21] The International Code of Conduct of the Flower Label Program contemplates the following standards and rights for a fair and ecological production: 1) freedom of association and collective bargaining; 2) equality of treatment with fairness; 3)dignified salary; 4)work schedules and payments following legal norms; 5)health and security; 6)controlled and technified use of pesticides and chemical products; 7)job security; 8) environmental protection; 9)no use of child labor; 10) no use of forced labor.

[22] In addition to the FLP, other seals have been framed in the vision of the entities that have advanced them, such as the MSP of Holland (that, although only getting started, seems that will also affiliate with the International Code of Conduct); Max Haavelar of Switzerland ("fair trade") that is also affiliated with the International Code of Conduct); the program of integral improvement of quality that has been brought forward by Swisscontact.

many agricultural collectivities of those regions, it is indispensable to integrate inter-institutional efforts that coordinate, impel and maintain the collective control over production and that support the activities of many local organizations, NGOs and groups that fight for a just and ecological agro-industry. In Ecuador the organization of the *Inter-Institutional Committee for the Socially and Environmentally Sustainable Development of Flowers for Export* is mobilizing a score of social and union organizations, entities of central and local governments, and NGOs, to advance several lines of action: organizational development; a system of information and monitoring; the development of standards; and the imposition of labor protection.

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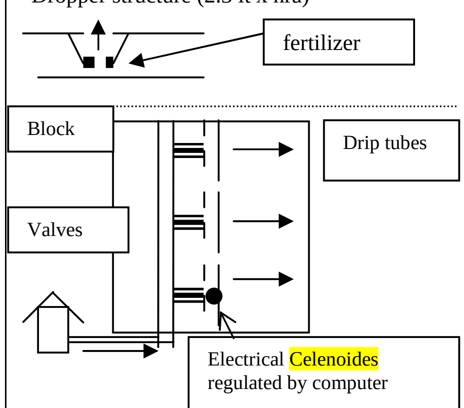
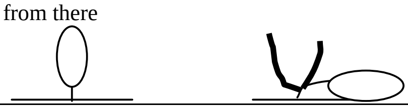
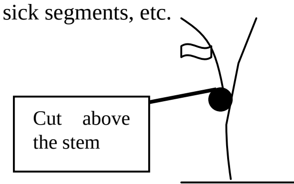
ANNEX N° 1

ELEMENTS FOR THE EPIDEMIOLOGICAL ANALYSIS OF THE PRODUCTION PROCESS OF CUT ROSES: TASKS BY PHASE/ AREA

PHASE / AREA	COMPONENTS	TASKS	EXPLANATION
Cultivation	Soil preparation	[1] Agricultural labors	* By hand or tractor to take out overgrowth, turn soil
		[2]Disinfection	
		[3]Preparation	* Organic corrections, according to analysis * Improvement to structure and texture, regulating the organic composition (e.g. husk of coffee can be added when looser soil is required
		[4]Testing of beds	* Evaluating the characteristics, including conductivity and pH, approving those that are ready
	Planting	[5]Analysis of vegetable density	* Deciding on the density of plants per bed. E.g. 258 plant x bed in double array The very productive varieties are planted in double lines to facilitate harvest (more compact, quick)
		[6]Planting with tools	* Markers * Marked Piolas * Rakes * Trenches when they are plants with large root system, if not, in glasses that are later withdrawn
	Irrigation	[7]Appply drip	* Dropper structure (2.3 lt x hra) 
		[8]Implement formulas	
		[9]Periodicity	
	Formation of plants (manual)	[10]De-budding	Take off the floral buds, from which more foliage sprouts, by de-budding, neighboring shoots are activated
		[11]Press	The plant is inclined when it is three months old (aprox. 40 cms) so that vasales will spring up from there 
		[12]Cuts	So that the plant takes form and more structure
	Production	[13] IPM Planning	Decide components of Integrated Pest Management that will be applied

PHASE / AREA	COMPONENTS	TASKS	EXPLANATION
		[14]Fertilization-irrigation/ humidity	Mixtures of water and fertilizers are applied according to soil variations under a program that allows a gradiation of the quantities of nitrogen, phosphorous and potassium according to conductivity, pH and soil parameters.
		[15]Soil Management	Aeration and addition of organic matter to elevate their composition.
		[16]Pinch	On each shoot a cut is made. The pinch is made to harvest the bud with its shaft, but it is also made to pull off sick segments, etc. 
Post-harvest	Cable-line reception	[17]Transport from blocks	The flower is transported in boxes that hang off the cable-line, hydrated with water and chlorine
	Classification	[18] classification	Classified according to variety and color, when the climate is hotter this step requires a cooling room.
	De-petal and selection according to points of cutting	[19]De-petal and cut by sizes	Pull off petals and estabish the cut points of the stem according to measurements.
	Bunching	[20]Bunching	The bunches are armed by placing the shafts against wooden blocks covered by the paper or plastic wrapper of the bunch.
	Quality control and send-off	[21]Send-off	Passed to quality control next to the computer and the final cuts are given to the stems to equal them.
	Marking of bunch	[22]Marking	The bunches are marked with a control label and bar codes are fixed.
	Hydration in salt	[23]Hydration	They are placed in a hydrating solution.
	Cold room packing (program)	[24]Packing	The bunches are packed in boxes and are held in the cold storage room.
Fumigat-ion			
Storage			
Mainten-ance			

Source: Personal communication with various flower growers.