The pesticide problem at the end of organization

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The Pesticide Problem at the End of Organization

In the 1990s I worked with Peter Groenewegen and Frank den Hond on "Environmental Effects and Societal Implications of Transformed Micropollutants", a project supported by a grant from VU-USF to stimulate transdisciplinary co-operation within the Graduate School of Environmental Sciences. We studied the problem of pesticides in modern agriculture and tried to develop a framework to analyse the problem, and to suggest improvements and alternatives. We organized an international workshop in Hotel Zuiderduin in Egmond and produced an edited book from the delegates' contributions, which was published in 2003 by Blackwell.

It is illustrative to cite the following phrase from the Preface of the book by Harmen Verbruggen, professor of International Economics and Director of the Institute of Environmental Studies at the time: "Since World War II, it has been impossible to imagine agriculture without the use of pesticides ... However, after more than 50 years ... the perceived blessings have faded, and for quite some observers, even turned out into a curse. It is certain, though, that the ignorance and negligence that long have accompanied the development and use of pesticides have vanished. Change is in the air. But what direction should this change take?"

Have our attempts to provide direction been successful? The book is still visible on the Internet but the problem has not been solved; if it has changed at all, it has worsened. Pesticides are held responsible, at least partly, for the extreme loss of biodiversity that has occurred in Western Europe over the last 25 years. Multinational companies specialized in pesticide production, as well as large parts of agriculture itself, are detested by some groups in society. In fact, according to a letter published on 14 June 2018 in the national newspaper *Volkskrant*, co-signed by 28 colleagues including myself, livestock farming in the Netherlands is said to be effectively bankrupt, surviving only because the environmental costs remain unpaid.

While the pesticide problem has not been resolved, despite our common project, my own development was permanently influenced by the co-operation with Peter Groenewegen and Frank den Hond. According to our views at the time, the pesticide problem included three "spheres",

depicted in Figure 1 below, and solutions would have to come from an approach taking all three aspects into account; they must involve changes to all three spheres in order to be successful.

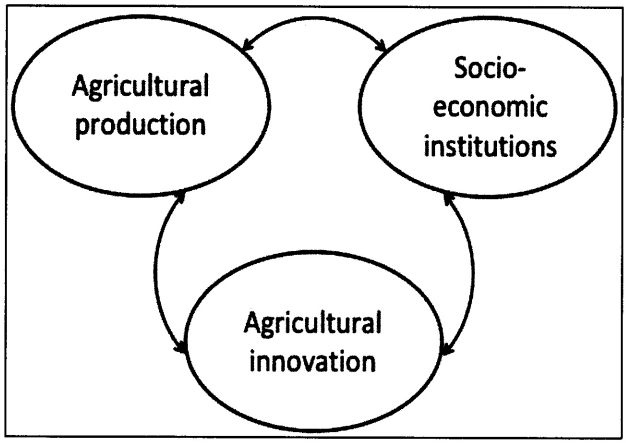

Figure 1: The three spheres of the pesticide problem, according to Den Hond, Groenewegen & Van Straalen, eds. (2003) Pesticides. Problems, Improvements, Alternatives. Blackwell Science Ltd., Oxford, ISBN 0-632-05659-2.

It is therefore quite understandable, when, in the beginning of 2018, the occasion was offered to me to write a Perspectives paper for *Science*, which I set out to argue along a course that is, in hindsight, very much in line with what we argued in 2003. Therefore, Peter Groenewegen is to be held at least partly responsible for our paper, published 1 June 2018. To make my point, I copy the paper below.

Decision making in a storm of discontent

Regulation of pesticides such as glyphosate needs to include societal assessment

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On 12 December 2017, the European Commission reapproved the use of glyphosate, the world's most widely used active ingredient in herbicides and possibly the most heavily debated plant protection product since DDT (dichlorodiphenyltrichloroethane), for another five-year period *(1)*.

Less than a week later, the U.S. Environmental Protection Agency (EPA) released its draft risk assessment for glyphosate, which concluded that human health risk levels associated with glyphosate exposure from food, drinking water, and residential sources are below the agency's levels of concern *(2)*. Both in Europe and in the United States these decisions faced a storm of public discontent owing to concerns about the possible risks of chemical exposure and the role of large multinational companies. We argue that a broader societal assessment should be included in the decision-making process on pesticide registration.

Is glyphosate safe or not?

The European Commission's decision to reapprove glyphosate was taken after lengthy and recurrent reviews by the European Chemicals Agency (ECHA), the European Food Safety Authority (EFSA), and the responsible ministries in member states of the European Union (EU). It was in line with conclusions reached by the Food and Agriculture Organization (FAO)-World Health Organization (WHO) Joint Meeting on Pesticide Residues on the carcinogenic risk to humans from dietary exposure *(3)*. It was not, however, in line with the International Agency for Research on Cancer (IARC) of the WHO, which classified glyphosate as a probable human carcinogen in 2015 and again in an updated review in 2017 *(4)*. The discrepancy between IARC's conclusions and the EU, WHO-FAO, and EPA assessments has been attributed to the use of different datasets and methods to evaluate the data *(5)*, which points to a lack of international standardization of risk assessment procedures.

Prior to the European Commission's decision and that of the EPA, non-governmental organizations (NGOs) had fought hard for years to curb the use of glyphosate-based herbicides. This ongoing plea has found support in an increasing number of scientific peer-reviewed articles, which have argued that glyphosate may have more profound ecotoxicological effects than concluded by regulatory authorities *(6, 7)*.

In the EU, the campaign to end the licence of glyphosate culminated in a European Citizens' Initiative that received over 1 million verified statements of support from 22 EU member states and was submitted to the European Commission on 6 October 2017 *(8)*. The European Commission defended its position, arguing that "there are neither scientific nor legal grounds to justify a ban of glyphosate" *(9)*. However, its decision to renew the licence of glyphosate for 5

years, rather than the more common 10 or 15 years, can be viewed as a compromise, requiring the Commission to revisit the approval of glyphosate on a shorter-than-usual time scale.

Explaining the divergent views

There are several reasons for the large discrepancy of views between regulatory authorities (except the IARC) on the one hand and some academic groups, several non-governmental organizations, and a substantial part of the general public on the other.

The glyphosate case is inherently complicated. Glyphosate inhibits a pathway of aromatic amino acid synthesis that is only present in plants, fungi, and bacteria and was therefore not expected to cause toxicity to animals *(7)*. However, glyphosate is an active ingredient in many different herbicide formulations. In addition to the active ingredient, formulated herbicides such as Roundup contain additional chemicals, called adjuvants, that improve herbicidal activity or application characteristics. The toxicity of several Roundup formulations to human cell lines has been mainly attributed to such adjuvants rather than to glyphosate itself *(10)*. The same is true for effects on ecological targets, although a smaller but separate effect of glyphosate cannot not be excluded in these studies *(11)*.

Thus, many of the claims for glyphosate toxicity in the literature may be due to effects of one or more adjuvants acting directly or through interaction with glyphosate *(7)*. Adjuvants are authorized under European legislation by including them on the "Official List of Adjuvants", but in the past these substances did not undergo a risk assessment comparable to the active ingredient. In its act on glyphosate *(1)*, the European Commission has now forbidden the use of polyoxyethylene tallow amines as adjuvants in plant protection products.

Another issue complicating decision-making on glyphosate-based herbicides is that their use is interwoven with the planting of genetically modified (GM) glyphosate-resistant crop varieties. The global use of glyphosate has increased 15-fold since the introduction of GM crops in 1996 *(12)*. Glyphosate-resistant GM crops are presently not grown in Europe, but their widespread culture in the United States and South American countries has resulted in appreciable residues of glyphosate on plant products such as soybeans, that are imported into Europe and used for food and feed production. This is aggravated by the use of glyphosate as a desiccant to kill foliage before harvest *(6)*. The glyphosate residues are generally in compliance with maximum residue levels (MRLs) set by the EFSA; however, when the EFSA raised the MRL for glyphosate in lentils from 0.1 to

proposed *(16)*. We argue that including such a framework in pesticide authorization would be an appropriate way to take factors such as citizens' initiatives, societal attitudes toward agricultural chemicals, and economic benefits of chemical pest and weed control into account.

In a recent commentary, EFSA's executive director, Bernhard Url, called for a broader societal discussion about the role of modern agricultural practices to be "framed ahead of and outside scientific work" *(17)*. We believe, however, that integration rather than a separate assessment is the way forward to move the discussion away from the present binomial decision of whether an individual pesticide is safe or unsafe. It is time for a new scheme for pesticide evaluation in which regulatory decision-making takes into account not only the technical evidence on safety, but also the societal context in which decisions are made.

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