Arsenic data availability in agricultural soils and waters in Europe

T. Hatakka & T. Tarvainen

Geological Survey of Finland, Espoo, Finland

ABSTRACT: The AgriAs project – Evaluation and management of arsenic contamination in agricultural soil and water has compiled a summary of European-wide databases and publications on As concentrations in agricultural soils and related water bodies, As concentrations in crops together with a list of gaps in data and knowledge. The literature review and the AgriAs questionnaire revealed that there is a large amount of nationwide or large-scale data on arsenic concentrations in soil, surface water and/or groundwater from many countries. However, none of the countries has published regional maps of arsenic concentrations in crops. According to the literature review and the questionnaire, no national-scale data on As concentrations in groundwater, stream water, sediment or topsoil are available from Belgium, Denmark, Estonia, Greece, Latvia, Moldova and Romania. Moreover, there are no data from European-wide mapping programmes for two countries: Moldova and Turkey. There is no up-to-date map of arsenic concentrations in European groundwater related to agricultural sites. There are quite extensive European-wide datasets on As concentrations in agricultural soil, but more detailed regional mapping at the national level is needed, especially in those areas where anomalously high As concentrations in topsoil have been discovered. According to the AgriAs studies, European-wide data, as well as the nationwide data, on As concentrations in crops are almost completely lacking. The AgriAs project provides the European Union with reliable data on the existing risks of arsenic exposure through agriculture, a complete summary of existing tools available for As remediation as well as an array of tools for ecotoxicity and bioavailability assessment.

1 INTRODUCTION

Arsenic is a toxic and carcinogenic substance. According to WHO, the greatest threat to public health from arsenic originates from contaminated groundwater. Food is another notable pathway for As exposure in humans. There are numerous arsenic-related publications and reports, but many of them focus on arsenic problems in South-East Asia or are limited to groundwater or contaminated soil. The AgriAs (Water-JPI 2017) project has focused on European data on agricultural soils and the quality of related surface water and groundwater.

2 METHODS

The AgriAs (<http://projects.gtk.fi/AgriAs/index.html>) Task Assessment of data availability on As concentrations in water, soil and crops in Europe has summarized European-wide databases and publications on As concentrations in soil and water. This was followed by a literature review and a questionnaire on national-level data sources of As concentrations in agricultural soil and water. A web-based AgriAs questionnaire on national and large-scale regional data sources on arsenic in soil, surface water, groundwater and crops in Europe was sent in May 2017 to 116 organizations from 23 countries. The selected organizations represented environmental authorities and research

organizations working on water quality, (agricultural) soil and environmental issues. The general findings concerning As concentrations in crops were summarized from the literature. Following the assessment of data availability, a list of major data gaps was reported.

3 RESULTS AND DISCUSSION

The AgriAs project has concentrated on European publications, reports and data related to arsenic. Reimann *et al.* (2009) have provided a comprehensive summary of the European-wide availability of data on As concentrations in soil and water. More up-to-date information on national and regional data sources were identified from the AgriAs questionnaire. The questionnaire revealed that regional-scale data are available on arsenic concentrations in soil and surface water. These data can provide a detailed insight into the European-wide anomalies found in the FOREGS (Salminen *et al.*, 2005), Baltic Soil Survey (Reimann *et al.*, 2003), GEMAS (Reimann *et al.*, 2015; Tarvainen *et al.*, 2015) and LUCAS surveys (Tóth *et al.*, 2015a, 2015b). The European-wide arsenic data availability is presented in Table 1. In addition, regional and national data are available on arsenic concentrations in groundwater, which have been lacking from the European-wide geochemical mapping programmes. Unfortunately, no publicly available

Table 1. The European-wide arsenic data availability in the Water JPI member countries in Europe. SW = Stream water, SD = Sediment, TS = Topsoil. The letters in bold indicate the maximum concentrations of As are relatively high (SW: As Max > 7 µg L⁻¹, SD and TS: As Max > 25 mg kg⁻¹, LUCAS TS: As Max > 50 mg kg⁻¹). White = no data available. FOREGS = Geochemical Atlas of Europe (Salminen *et al.*, 2005), BSS = Baltic Soil Survey (Reimann *et al.*, 2003), GEMAS = Geochemistry of European agricultural and pasture soils (Reimann *et al.*, 2015), LUCAS = Lucas topsoil survey (Toth *et al.*, 2015a, 2015b).

Country	FOREGS		GEMAS Agricultural Soil	LUCAS Agricultural Soil
	Agricultural Soil	Catchments		
Austria	SW, SD, TS		TS	TS
Belgium			TS	TS
Cyprus			TS	TS
Denmark			TS	TS
Estonia	SW, SD, TS	TS	TS	TS
Finland		TS	TS	TS
France	SW, SD, TS		TS	TS
Germany	SW, SD, TS	TS	TS	TS
Greece			TS	TS
Hungary	SW, SD, TS		TS	TS
Ireland			TS	TS
Italy	SW, SD, TS		TS	TS
Latvia	SW, SD, TS	TS	TS	TS
Moldova				
The Netherlands			TS	TS
Norway		TS	TS	TS
Poland	SW, SD, TS	TS	TS	
Portugal	SW, SD, TS		TS	TS
Romania				TS
Spain	SW, SD, TS		TS	TS
Sweden		TS	TS	TS
Turkey				
United Kingdom	SW, SD, TS		TS	TS

national or regional datasets were reported on arsenic concentrations in crops.

According to the literature review and the questionnaire, no national-scale data on As concentrations in groundwater, stream water, sediment or topsoil are available from Belgium, Denmark, Estonia, Greece, Latvia, Moldova or Romania. There are no data from European-wide mapping programmes for two countries: Moldova and Turkey.

4 CONCLUSIONS

There are quite extensive European-wide datasets on As concentrations in agricultural soil, but more detailed regional mapping at the national level is needed, especially in those areas where anomalously high As concentrations in topsoil have been discovered. According to the AgriAs questionnaire and

literature study, European-wide data as well as nation-wide data on As concentrations in crops are entirely lacking. There is no up-to-date map of arsenic concentrations in European groundwater related to agricultural sites. European-wide or large-scale regional databases very seldom combine arsenic concentrations in agricultural topsoil with concentrations in adjacent surface water or groundwater.

The AgriAs project provides the European Union with reliable data on the existing risks of arsenic exposure through agriculture, a complete summary of existing tools available for As remediation as well as an array of tools for ecotoxicity and bioavailability assessment.

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