Advisory & KT Tools and Processes to Support Potato Farmers and Agronomists to Assess their Exposure to Risk of Cadmium

Blair Ruffing BSc, MSc

Supervisors: Dr. Monica Gorman, UCD and Mr. Shay Phelan, Teagasc

INTRODUCTION

- Cadmium (Cd) is a heavy metal found in soils all around the globe
- Cd is a toxic metal that accumulates in crops grown for consumption and can cause harm to human health if consumed in high enough concentrations[1]
- Sources of Cd in Ireland are geogenic, accumulating in high concentrations where the bedrock type is dominated by impure limestone[2]

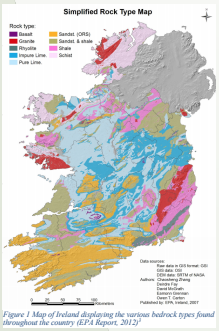

Figure 1 Map of Ireland displaying the various bedrock types found throughout the country (EPA Report, 2012)[3]

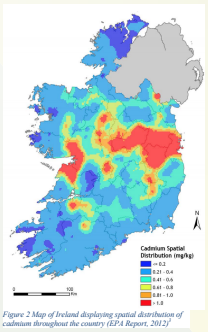

Figure 2 Map of Ireland displaying spatial distribution of cadmium throughout the country (EPA Report, 2012)[3]

- European Union (EU) policy permits a maximum level of 0.1 mg of Cd per kg of fresh weight (FW) potatoes; however, it is possible that policy makers might lower the maximum permitted level to 0.075 mg Cd/kg FW potatoes[4]

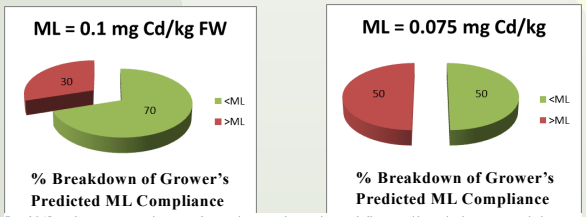

Figure 3 & 4 Pie graphs representing estimated percentages of potato produce grown in the impacted area at risk of being rejected for exceeding the current maximum level requirement set for cadmium (on the left) and pie graph representing estimated percentage of potato produce grown in the impacted area at risk of being rejected for exceeding the proposed decreased maximum level for cadmium (on the right) (CREDIT Project, 2018)[5]

- Decision Support Tool (DST) developed to provide quality advise to potato growers after they receive results from a soil test with a cadmium analysis

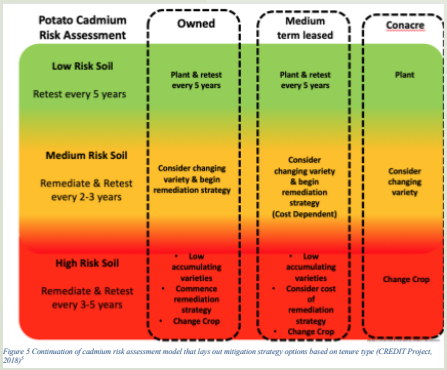

Figure 5 Continuation of cadmium risk assessment model that lays out mitigation strategy options based on tenure type (CREDIT Project, 2018)[5]

OBJECTIVES

- Assess the influences affecting potato growers and agronomists' risk assessment of available soil cadmium and their adoption of the cadmium risk assessment model
- Evaluate the effectiveness and uptake of the cadmium risk assessment model proposed for farmers and agronomists
- Analyse extension tools and processes for both building engagement in the potato growing community and making an impact on the farmer decision making process

METHODOLOGY

1. Knowledge and attitudinal survey of growers in the affected area (n=39)
2. Knowledge and attitudinal survey of agronomists in the affected area (n=7)
3. Brief case studies of growers in the affected areas (n=3)

FARMER RESULTS

- Familiarity with cadmium issue and policy regulations were very low
- Likelihood of implementing cadmium mitigation strategies (MS) was high
- Level of concern on short-term rented land was highest amongst farmers aged 21-40
- Although most growers stated they would interact with the cadmium DST in the interview, only 5 of the 39 growers engaged with the model

Figure 6 Color coded representation of proactivity levels displayed by potato growers

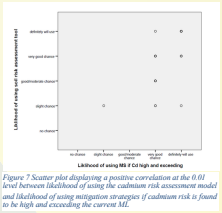

Figure 7 Scatter plot displaying a positive correlation at the 0.01 level between likelihood of using the cadmium risk assessment model and likelihood of using mitigation strategies if cadmium risk is found to be high and exceeding the current ML

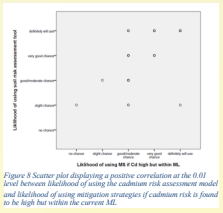

Figure 8 Scatter plot displaying a positive correlation at the 0.01 level between likelihood of using the cadmium risk assessment model and likelihood of using mitigation strategies if cadmium risk is found to be high but within the current ML

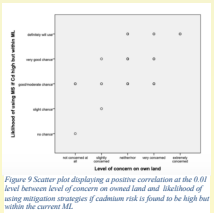

Figure 9 Scatter plot displaying a positive correlation at the 0.01 level between level of concern on owned land and likelihood of using mitigation strategies if cadmium risk is found to be high but within the current ML

AGRONOMIST RESULTS

- Very high level of awareness and concern about cadmium issue
- Knowledge of possible mitigation strategies (MS) was low
- Rate of advising clients about cadmium mitigation strategies (MS) was even lower
- **"We were invited to meetings about this a few years ago but because it was so vague and nothing really came from it, we really did nothing about it. We did get some soil analysis done and we got them done in and around the UK" (Agronomist A)**

FARMER CASE STUDY #1 RESULTS

Table 1 Copy of sample result summary provided to grower after running lab results through the cadmium risk assessment model

Sample Label		Estimated tuber-Cd (mg/kg)	Probability of tuber-Cd exceeding the current ML (0.1 mg Cd/kg FW)
SS-483613	EED/220	0.147	Very high (> 80%)
SS-483614	EED/221	0.114	High (60%)

Table 4.4 Copy of grower's soil risk index rating for the tested samples and associated mitigation strategy advice

Soil Risk Index	Implement remediation strategies?	Use low-Cd varieties?	Start soil remediation?	Change crop?	Estimated tuber-Cd (mg/kg)	Probability of complying (%)	Tested sample SS-483613	Tested sample SS-483614
Low	No	-	-	-	<0.05	>99%		
Low-Medium	Yes	-	Yes	-	0.05-0.070	78%-99%		
Medium	Yes	Yes	Yes	-	0.071-0.099	50%-78%		
High	Yes	Yes	Yes	Yes	0.01-0.12	30%-50%		X
Very High	No	-	-	Yes	>0.121	<30%	X	

REFERENCES

[1] Liu, Y., Xiao, T., Perkins, R.B., Zhu, J., Zhu, Z., Xiong, Y., Ning, Z., 2017. Geogenic cadmium pollution and potential health risks, with emphasis on black shale. Journal of Geochemical Exploration, Potentially Toxic Metals in the Environment 176, 42–49. https://doi.org/10.1016/j.gexplo.2016.04.004

[2] Satarug, S., Garrett, S.H., Sens, M.A., Sens, D.A., 2010. Cadmium, Environmental Exposure, and Health Outcomes. Environmental Health Perspectives 118, 182–190.

[3] Lehane, M., O'Leary, B., 2012. Ireland's Environment 2012- An Assessment. Environmental Protection Agency, Ireland.

[4] 'Comission Regulation (EC) No 1881/2006 on setting maximum levels for certain contaminants in foodstuffs' (2006) *Official Journal* L364, 20.12.2006, pp. 5-24.

[5] Phelan, S. (2018). 'CREDIT Project- Task 8' [PowerPoint presentation].