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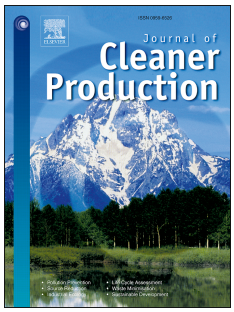

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PII: S0959-6526(18)31308-8

DOI: 10.1016/j.jclepro.2018.04.266

Reference: JCLP 12847

To appear in: *Journal of Cleaner Production*

Received Date: 30 November 2017

Revised Date: 8 April 2018

Accepted Date: 29 April 2018

Please cite this article as: Steingrimsdottir MM, Petersen A, Fantke P, A screening framework for pesticide substitution in agriculture, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.04.266.

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A screening framework for pesticide substitution in agriculture

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Abstract

Farmers lack science-based tools to flexibly and rapidly identify more sustainable pesticides. To address this gap, we present a screening-level substitution framework to compare and rank pesticides using a consistent set of indicators including registration, pest resistance, human toxicity and aquatic ecotoxicity impact potentials, and market price. Toxicity-related damage costs and application costs were combined with application dosages to yield total costs per pesticide. We applied and tested our framework in a case study on pesticides applied to lettuce in Denmark. Our results indicate that by ranking pesticides within each target class (e.g. fungicides) the most suitable pesticide can be identified based on our set of indicators. As an example, in the insecticide scenario, pymetrozine performs best with total costs of 23 €/ha, while dimethoate and pirimicarb, which are also on the EU candidate substitution list, performed worst. Total costs across considered pesticides range from 23 to 302 €/ha. Our framework constitutes an operational starting point for identifying sustainable pesticides by farmers and other stakeholders and highlights (a) the need to consider various relevant aspects influencing the ranking of pesticides and (b) the importance of combining total cost performance per pesticide unit applied with respective application dosage per hectare as both may vary greatly. Fu-

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