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**PESTICIDE MAXIMU RESIDUE LIMITS (MRL) IN LETTUCE (HEAD AND LEAF TYPES)
 ESTABLISHED BY CODEX, ASEAN, PHILIPPINES, SELECTED IMPORTING AND
 EXPORTING COUNTRIES**

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Executive Summary

Lettuce, the well-known “salad green,” is a high-value commercial crop in the Philippines and is considered one of the most economically important leafy vegetables in the world (Bureau of Plant Industry [BPI], n.d.; Litzelman, 2017; Poliquit, 2019). It is notably low in calories, fat, and sodium, making it a good choice for a healthy diet and trying to manage weight (Bunning & Kendall, 2012; Harvard Health, 2021; Kim et al., 2016). A 100 grams of lettuce provides 22 kilocalories, consisting of 1.8 g of fiber, 19 mg of vitamin C, 1800µg of beta-carotene, 150 µg of Retinol Activity Equivalent (RAE), 97 mg of Calcium, 34 mg of Phosphorus, and 3.4 mg Iron (Department of Science and Technology, Food and Nutrition Research Institute [DOST-FNRI], 2019).

Lettuce is categorized into two main types: head lettuce, commonly known as iceberg lettuce, and leaf lettuce, which includes romaine or cos, butterhead, and other leaf types (Agricultural Marketing Resource Center [AgMRC], 2021). In 2021, the Philippines produced 4.57 thousand Metric Tons (MT) of lettuce (Philippine Statistics Authority [PSA], 2023) and imported 36.6 thousand MT of lettuce originating from China, Australia, Brazil, Ukraine, and France. The country also exported 392 MT of lettuce to South Korea, Maldives, and Japan (Observatory of Economic Complexity [OEC], 2023; Tridge, 2023). Locally, Iceberg lettuce is the most commonly grown variety (Department of Agriculture- Regional Field Office II, High Value Crops Development Program [DA-RFO II, HVCDP], 2017).



While lettuce provides direct nutritional benefits to consumers, it is at risk of chemical contamination due to the presence of pesticide residues, which may pose risks to consumer health (Balkan & Yilmaz, 2022). There is a considerable food safety risk since lettuce is predominantly consumed in its raw form (Santarelli et al., 2018; Sun et al., 2018). Lettuce is highly sensitive to pests and disease (i.e., aphids and downy mildew) that requires successive application of pesticide treatments, such as fungicides (i.e., mancozeb and methiram) and insecticides (i.e., deltamethrin and lambda-cyhalothrin) during its production, which can result in the presence of higher pesticide residues on lettuce (Barrière et al., 2013; Horská et al., 2020; González-Rodríguez et al., 2008).

Studies by Elgueta et al. (2017), Esturk et al. (2014), and Skovgaard et al. (2017) have consistently reported the detection of pesticide residues in head and leaf lettuce samples that have exceeded the Maximum Residue Limit (MRL) established by the Codex Alimentarius Commission (CAC), European Union (EU), and the United States (US). The levels of pesticide residue vary depending on the lettuce type with different leaf and head morphologies (Ripley et al., 2003), where pesticide residues were observed highest in leaf lettuce types and lowest in head lettuce types (Parks & Lindhout, 2008).

To address potential health risks associated with pesticide residues, countries have established an MRL in fresh agricultural products including lettuce (World Health Organization [WHO], 2022). In the Philippines, a Philippine National Standard (PNS) on MRL of Pesticides on Selected Local Crops (PNS/BAFS 265:2018) and MRL of Pesticides on Selected Imported Crops PNS/BAFS 292:2020 were established. The PNS/BAFS 265:2018 covers coffee beans, eggplant, garlic, onion, tomato, string beans, and bitter melon, and the PNS/BAFS 292:2020 covers apple, citrus fruits, grapes, longgan, lychee, oranges, and pears. However, none specific to lettuce is included. Therefore, establishing a PNS on pesticide MRL for lettuce is necessary to ensure consumer safety and facilitate trade.

The development of PNS on MRL of pesticide on lettuce was requested by the DA-RFO II, Integrated Laboratories Division (ILD) in 2021 to support their efforts in promoting pesticide-safe vegetables (DA-RFO II, ILD Accomplished Project Document Form). Lettuce

has high market potential due to the increasing demand for salad vegetables from hotels, supermarkets, restaurants, fast-food chains, and high-end food service companies (Fangasan, 2009; Rodriguez, 2018). Therefore, conformance with pesticide MRL established by international standards is considered imperative.

This study aimed to identify the MRL for pesticide active ingredients for lettuce, both head and leaf type, established by Codex Alimentarius Commission (Codex) as the benchmark standard and compare it with the MRL established by the Association of Southeast Asian Nations (ASEAN), registered with the Department of Agriculture-Fertilizer and Pesticide Authority (DA-FPA), and by selected importing and exporting countries with available MRL, namely China, Australia, Brazil, South Korea, Japan, and EU member countries-(Ukraine and France). The data derived from the study will serve as a basis for the development of PNS on MRL of Pesticides in Lettuce (Head and Leaf type). Secondary data was collected from online pesticide MRL databases, regional and international standards, government websites, and Codex.

The major findings of this study are as follows:

1. The pesticide MRL for lettuce varied by country and region due to many factors, including differences in Good Agricultural Practices (GAP), dietary risk assessment results, patterns of pesticide application, crop morphology, physicochemical characteristics of pesticides, locations of the field crop trials applied to generate residue chemistry data and the commodity description used.

The DA-FPA, EU, Brazil, and Japan had presented pesticide MRL in their database as “lettuce,” covering both head and leaf types. While the Codex, ASEAN, China, Australia, and South Korea provided separate MRL for both head and leaf lettuce types.

2. There were 54 combined pesticide active ingredients with established MRL from DA-FPA, EU, Brazil, and Japan under the lettuce category. Of the 54 pesticide active ingredients, Codex had established 47 pesticide MRL for head lettuce and 30 pesticide MRL for leaf lettuce. Only five pesticide active ingredients (chlorothalonil, mancozeb,

propamocarb hydrochloride, propineb, and thiophanate-methyl) were registered in the DA-FPA. A total of 49 pesticide active ingredients in Codex were not registered for lettuce in the Philippines.

Propamocarb hydrochloride in DA-FPA had a corresponding pesticide MRL in Codex for head and leaf lettuce but its MRL alignment with Codex was not determined since information on proposed MRL can no longer be retrieved. Four active ingredients registered in DA-FPA (chlorothalonil, mancozeb, propineb, and thiophanate-methyl) had no corresponding MRL in Codex. Most of the five active ingredients registered in DA-FPA had corresponding MRL in the EU, Brazil, and Japan. However, only the proposed MRL for propineb was provided by DA-FPA, which was found to be more lenient than the EU MRL but stricter than the MRL of Brazil.

- There were 47 combined pesticide active ingredients with MRL established by Codex, ASEAN, China, Australia, and South Korea specifically for head lettuce. A harmonized MRL value with the Codex standards was noted for the 10 pesticide active ingredients (carbendazim, cycloxydim, cyromazine, diazinon, dimethoate, imidacloprid, iprodione, metalaxyl, methomyl, and permethrin) in ASEAN and 36 pesticide active ingredients in China. Furthermore, three pesticide active ingredients (flubendiamide, fluopyram, trifloxystrobin) in Australia, and eight pesticide active ingredients (acibenzolar-s-methyl, cyantraniliprole, flupyradifurone, flutriafol, isofetamid, methoxyfenozide, pyrimethanil, and trifloxystrobin) in South Korea were also harmonized with Codex standards.

The MRL of one active ingredient (dithiocarbamates) in ASEAN, nine pesticide active ingredients (cyromazine, fenhexamid, fluxapyroxad, imidacloprid, isofetamid, methomyl, methoxyfenozide, permethrin, pyrimethanil) in Australia and twelve pesticide active ingredients in South Korea were observed to be more lenient than Codex standards for head lettuce. Moreover, a stricter MRL than the Codex standards was noted for the seven pesticide active ingredients (benalaxyl, emamectin benzoate, indoxacarb, iprodione, oxathiapiprolin, pyraclostrobin, and tebuconazole) in Australia and seven

pesticide active ingredients (emamectin benzoate, fluensulfone, fluopyram, glufosinate-ammonium, metalaxyl, spinetoram, and tebuconazole) in South Korea.

- There were 30 combined pesticide active ingredients with established MRL from Codex, ASEAN, China, Australia, and South Korea specifically for leaf lettuce. A harmonized MRL value with the Codex standards was noted for four active ingredients (cycloxydim, diazinon, iprodione, and methomyl) in ASEAN, and iprodione in China. Likewise, three pesticide active ingredients (fluopyram, methoxyfenozide, and pendimethalin) in Australia and three pesticide active ingredients (isofetamid, oxathiapiprolin, and pendimethalin) in South Korea were harmonized with Codex standards.

The MRL of three pesticide active ingredients (cyromazine, difenoconazole, and dimethomorph) in China, three pesticide active ingredients (fenhexamid, isofetamid, and methomyl) in Australia, and seven pesticide active ingredients (azoxystrobin, difenoconazole, dimethomorph fenpyrazamine, flonicamid, flubendiamide, and indoxacarb) in South Korea were observed to be more lenient than Codex standards for head lettuce. Furthermore, stricter MRL than the Codex standards was noted for emamectin benzoate in China, two pesticide active ingredients (emamectin benzoate, iprodione) in Australia, and six pesticide active ingredients (acibenzolar-s-methyl, emamectin benzoate, fludioxonil, fluopyram, methoxyfenozide, and spinetoram) in South Korea.

The major recommendations of the study are as follows:

- BAFS to adopt the Codex pesticide MRL separately for head lettuce and leaf lettuce with due consideration to risks to Filipino consumers, to be consistent with the obligations under the World Trade Organization (WTO) – Sanitary and Phytosanitary (SPS) Agreement.
- DA-FPA to provide the proposed MRL for the four pesticide active ingredients (chlorothalonil, mancozeb, propamocarb hydrochloride, and thiophanate-methyl) registered for lettuce.

3. DA-FPA may consider re-evaluation of the pesticide risk assessment conducted for the four pesticide active ingredients (chlorothalonil, mancozeb, propineb, and thiophanate-methyl) registered for lettuce that had proposed MRL value but no corresponding MRL in Codex.

