MITIGATING STRATEGIES FOR ARSENIC IN RICE: THE PRODUCER'S PERSPECTIVE

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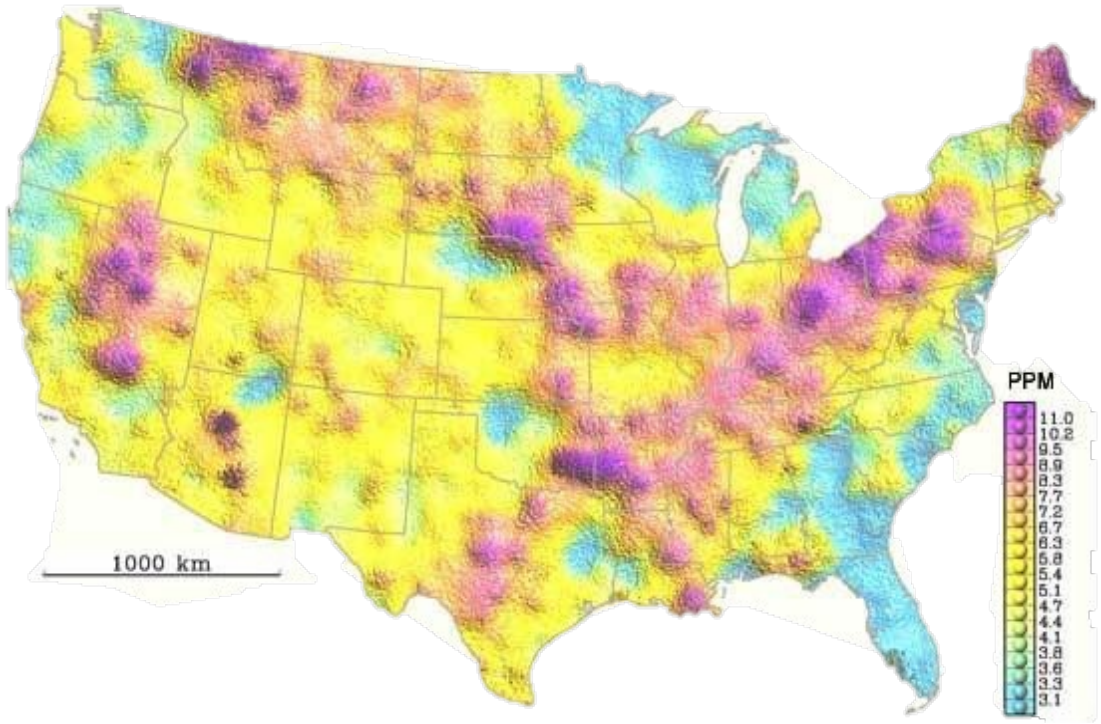
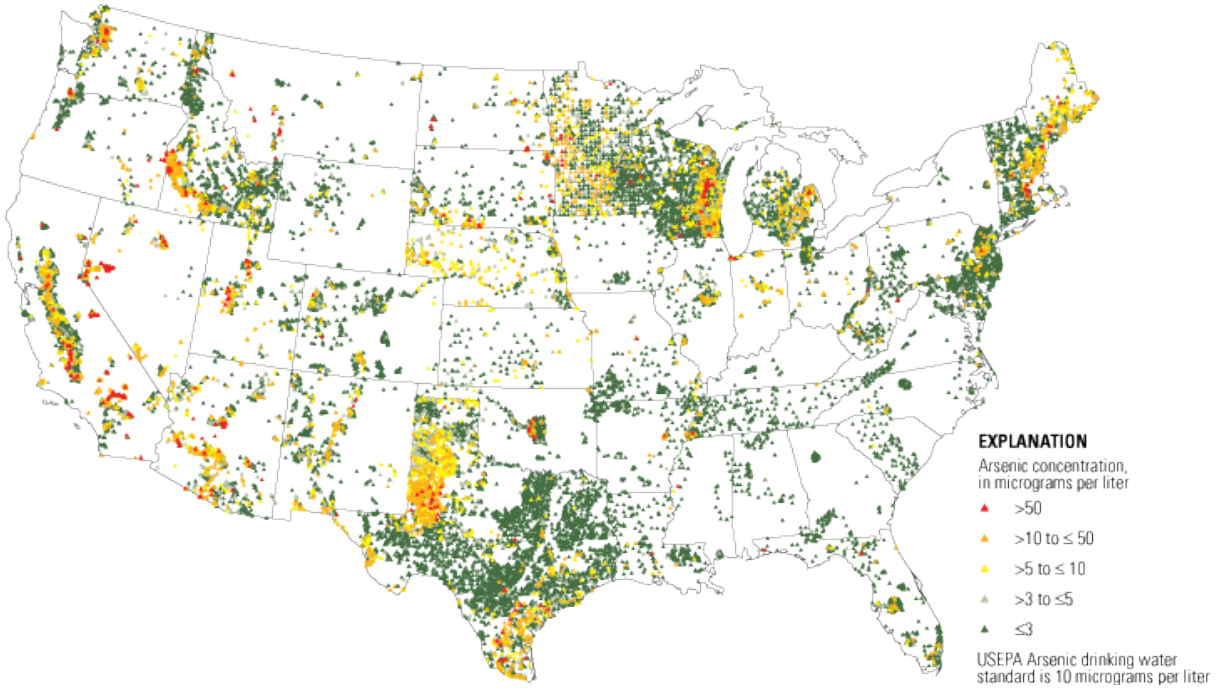
WHAT IS ARSENIC?

Arsenic Concentration in Soil



Arsenic Concentration in Groundwater

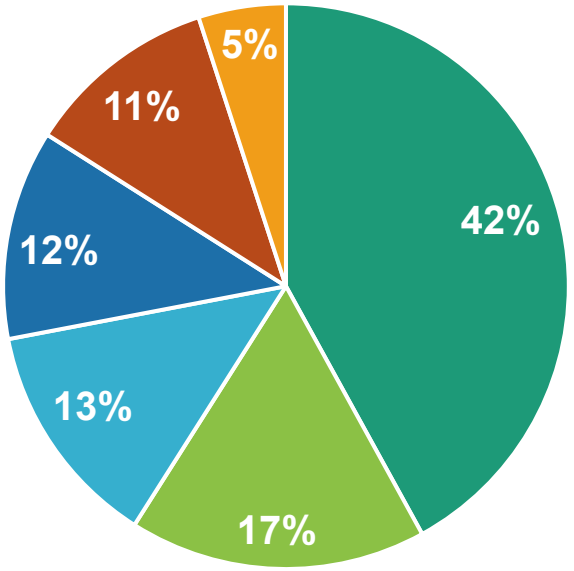


Source: United States Geological Survey (USGS)

HISTORY OF ARSENIC AND RICE

CR Consumer Reports™

Common Dietary Sources of Inorganic Arsenic



- 42% vegetables, fruit, fruit juice
- 17% rice
- 13% other sources
- 12% beer/wine
- 11% flour, corn, wheat
- 5% poultry, pork, beef, eggs

Xue, J., et, al. (2010). Probabilistic Modeling of Dietary Arsenic Exposure and Does and Evaluation with 2003-2004 NHANES Data. *Environmental Health Perspectives*, Volume 118, No.3.
https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.0901205

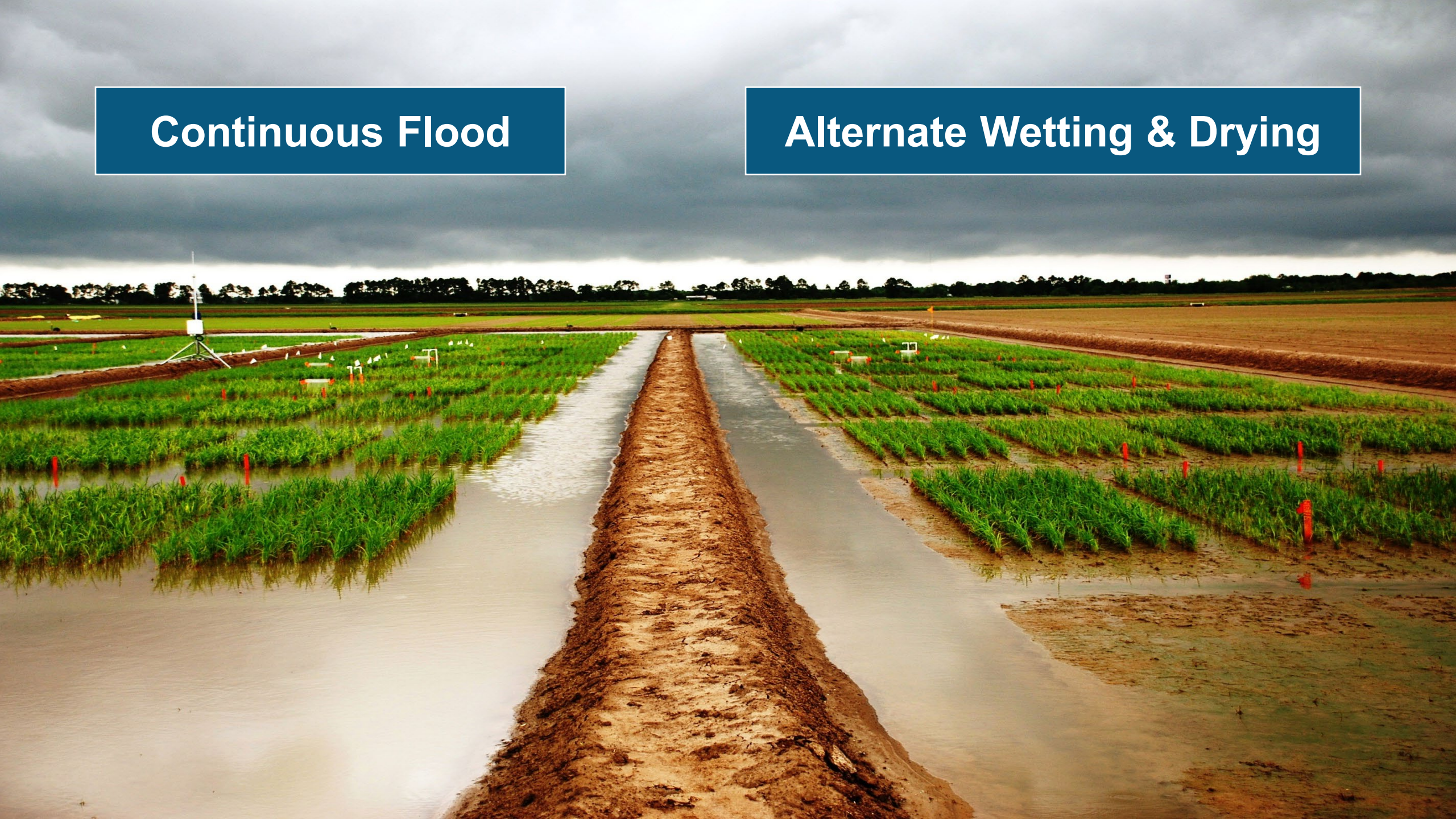
AG/FOOD INDUSTRY IMPLICATIONS

ARSENIC ACCUMULATION IN RICE PRODUCTION

- The U.S. annually produces rice on 2.5–3 million acres with the primary production in Arkansas, California, Louisiana, Mississippi, Missouri, and Texas.
- U.S. rice is typically grown under flood irrigation.
- The flooded soil results in anaerobic conditions which increases AS availability and uptake by rice.
- Growing rice under non-flooded soil conditions has been shown to reduce grain AS.
- Some evidence that there is a difference among rice varieties in AS uptake – more research needed here.

SELECTED RICE GROWING TECHNIQUES

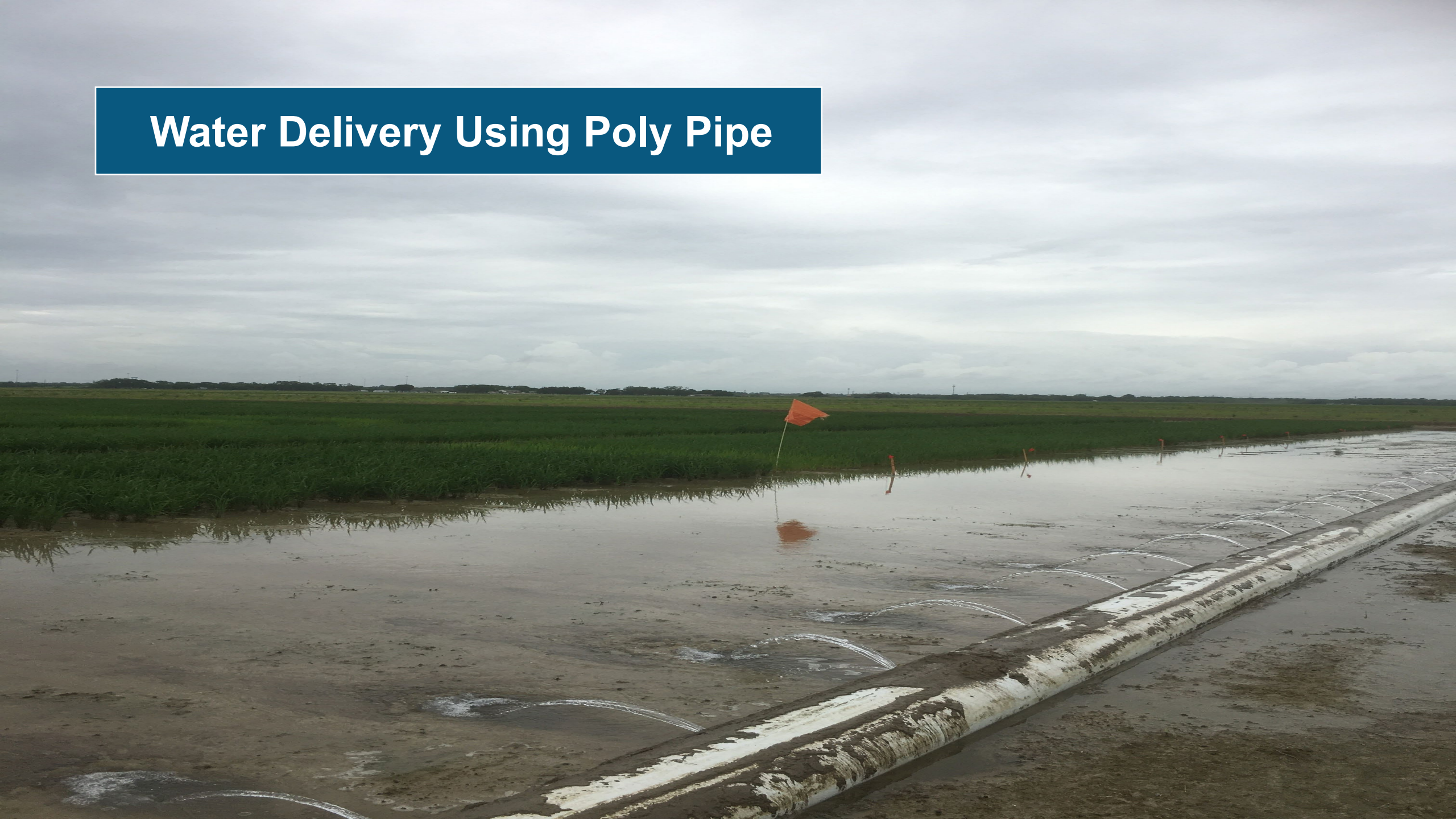
- Alternative flood management techniques that aerate soils during the production cycle have been shown to reduce accumulation of grain AS.
- Alternate Wetting and Drying (AWD) allows for soil surface exposure (thus some aeration) during the production cycle.
- Furrow Irrigated (Row Rice) allows for rice on one half to two thirds of the field to grow under upland conditions during the growing season.
- However, AWD and/or Furrow Irrigation is not suitable for all rice production systems and can lead to yield reductions.


Continuous Flood
Alternate Wetting & Drying

Furrow Irrigation

Furrow Irrigation

Water Delivery Using Poly Pipe

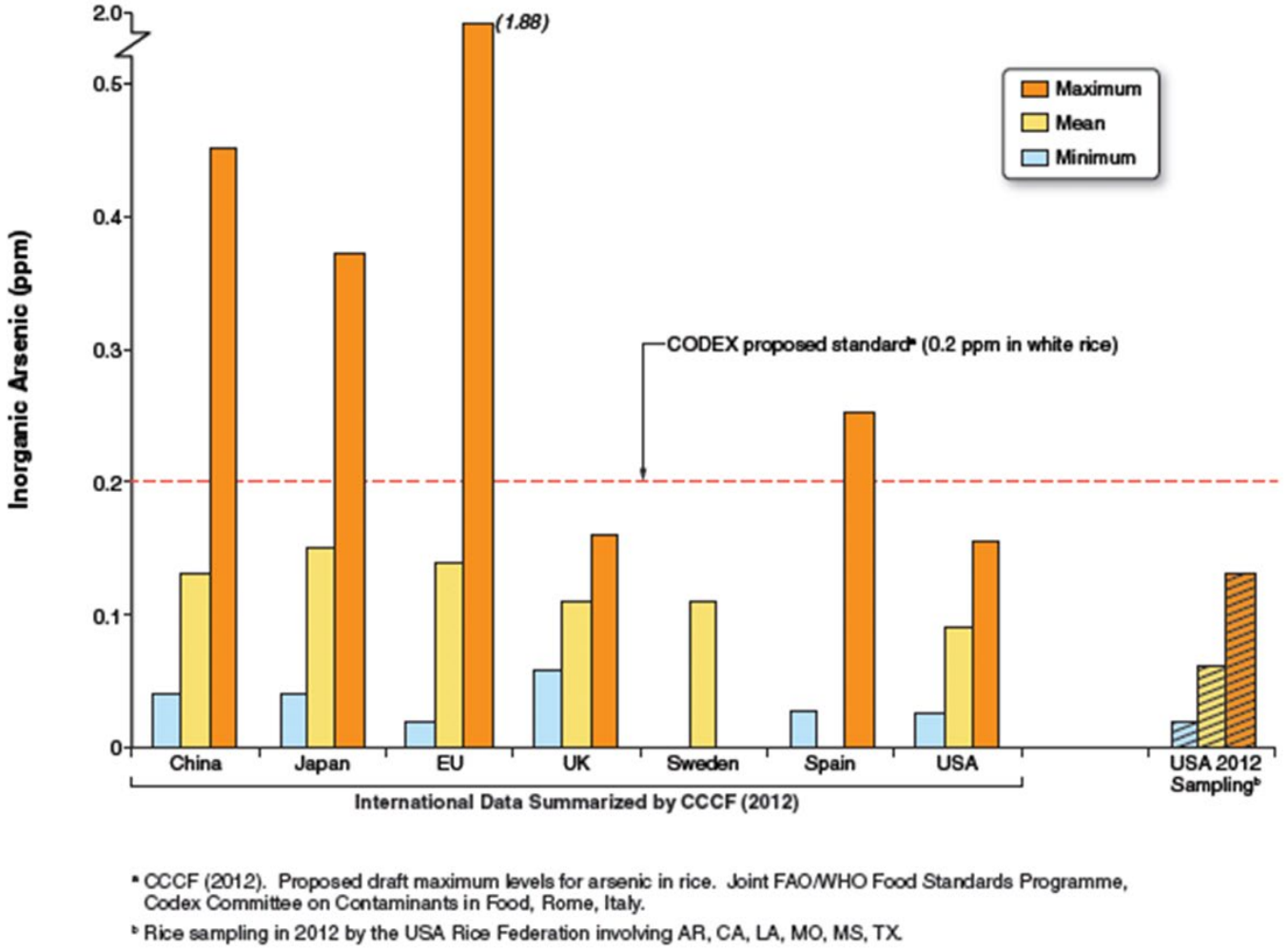


APPROPRIATENESS OF U.S.-GROWN RICE

- **U.S. Rice Meets Domestic & International Regulatory Standards**
  - The U.S. Food and Drug Administration (FDA) set an action level of 100 parts per billion (ppb) for inorganic arsenic in rice cereal for infants[1].
  - The World Health Organization (WHO) and the Food and Agricultural Organization of the United Nations (FAO) set limits of 200 ppb for white rice and 350 ppb for brown[2].
- **Health Experts Recommend Rice**
  - Grains, such as rice, are highly recommended as a part of a healthy diet to reduce the risk of heart disease, support healthy digestion, and help with weight management[3].
  - National Health and Nutrition Examination Survey (NHANES) data show that consumption of infant rice cereal in the 0-24-month population was linked to better nutrient intake, which leads to better overall health and lower risk of disease[4]. In fact, the *2020-2025 Dietary Guidelines for Americans* recommends infant rice cereal consumption[3].

[1] U.S. Food and Drug Administration. *Guidance for Industry: Action Level for Inorganic Arsenic in Rice Cereals for Infants*. August 2020. https://www.fda.gov/media/97234/download
[2] CODEX Alimentarius. Maximum level of inorganic arsenic in husked rice. June 2016. http://www.fao.org/fao-who-codexalimentarius/roster/detail/en/c/421755/
[3] U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2020-2025. 9th Edition. December 2020. Available at DietaryGuidelines.gov
[4] Nicklas, T. A., O'Neil, C. E., & Fulgoni, V. L., 3rd (2020). Nutrient intake, introduction of baby cereals and other complementary foods in the diets of infants and toddlers from birth to 23 months of age. AIMS Public Health, 2020, 7(1): 123-147. https://doi.org/10.3934/publichealth.2020012

U.S. RICE – LOWEST INORGANIC ARSENIC LEVELS IN THE WORLD



[a] CCCF (2012). Proposed draft maximum levels for arsenic in rice. Joint FAO/WHO Food Standards Programme, Codex Committee on Contaminants in Food, Rome, Italy.

[b] Rice sampling in 2012 by the USA Rice Federation involving AR, CA, LA, MO, MS, TX.

Codex Committee on Contaminants in Foods. (2012). Proposed Draft Maximum Levels for Arsenic in Rice. CX/CF/12/6/8. http://dx.doi.org/10.13140/RG.2.1.3879.0884

AN UNPARALLELED COMMITMENT TO FOOD SAFETY

The U.S. rice industry remains committed to providing healthy and nutritious food to consumers and will continue to work with farmers and processors, as well as regulatory agencies, to provide accurate and transparent information about all aspects of U.S. rice and rice products.

FOOD SAFETY MANAGEMENT PRACTICES TASK FORCE

USDA/AFRI GRANT PREPARATION

- USA Rice is coordinating the development of a multi-state, multi-discipline ARFI grant proposal to conduct multi-faceted research to reduce inorganic arsenic accumulation in U.S. produced rice.
- The research will be conducted by researchers from land grant (and other) universities in the six major rice producing states (Arkansas, California, Louisiana, Mississippi, Missouri and Texas). Researchers include agronomists, soil scientists, breeders, economists and social scientists.

USDA/AFRI GRANT PREPARATION

Specific Objectives:

1) Identify current and potential alternative rice production practices that move us “Closer to Zero”. (Alternative flooding practices can have the added benefit of reducing methane production in rice fields.)
2) To determine if breeding for rice varieties with lower AS accumulation can be effective.
3) Develop an adaptive computational model (producer decision support tool).
4) To validate the effectiveness of the decision support tool.
5) To develop an extension platform that broadly and rapidly disseminates new technologies to the rice industry and the public.
6) To innovate education of the next generation of rice producers and scientists.

QUESTIONS?

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