Grant Information: Institution, Principal Investigator(s), Contact Information, Grant Number	**University of Massachusetts** **Project:** A Novel Strategy for Arsenic Phytoremediation **Project Leaders**: Om Parkash Dhankher, Venkataraman Dhandapani, Jason C. White, Baoshan Xing **Grant Number:** R01ES032686 **Funding Period:** 2021-2025
Technology	Developing a genetics-based phytoremediation strategy for arsenic uptake, translocation, detoxification, and hyperaccumulation into the fast-growing, high biomass, non-food oilseed crop *Crambe abyssinica*.
Innovation	**Materials:** Nanosulfur will be utilized to modulate the bioavailability and phytoextraction of arsenic from soil and to increase the storage capacity via enhanced sulfur assimilation. **Biological:** We are engineering a fast-growing, high biomass, non-food crop *Crambe abyssinica* to remediate arsenic-contaminated soil. **Why is this technology/approach different than what is already in the market?** We are using a gene pyramiding approach to co-express several genes that control the transport, oxidation state, and binding of As for efficient extraction and hyperaccumulation into above-ground plant tissues of *Crambe abyssinica*. Phytoremediation is a cost-effective and ecologically friendly alternative to physical remediation methods.
Contaminant and Media	**Contaminants:** Arsenic **Media:** Soil, sediment, and maybe water
Expansion Potential	**Looking Forward: What other contaminants/media would work for your technology?** Toxic metals: Pb, Cd, Hg, Cr **Combined Remedy: Would this technology work well with other treatment approaches?** Yes, this approach could be combined with biofuels production on contaminated sites.
Sites/Samples	We are using artificially contaminated soils, but will use the real-world samples, like field soils contaminated with As and other toxic metals.

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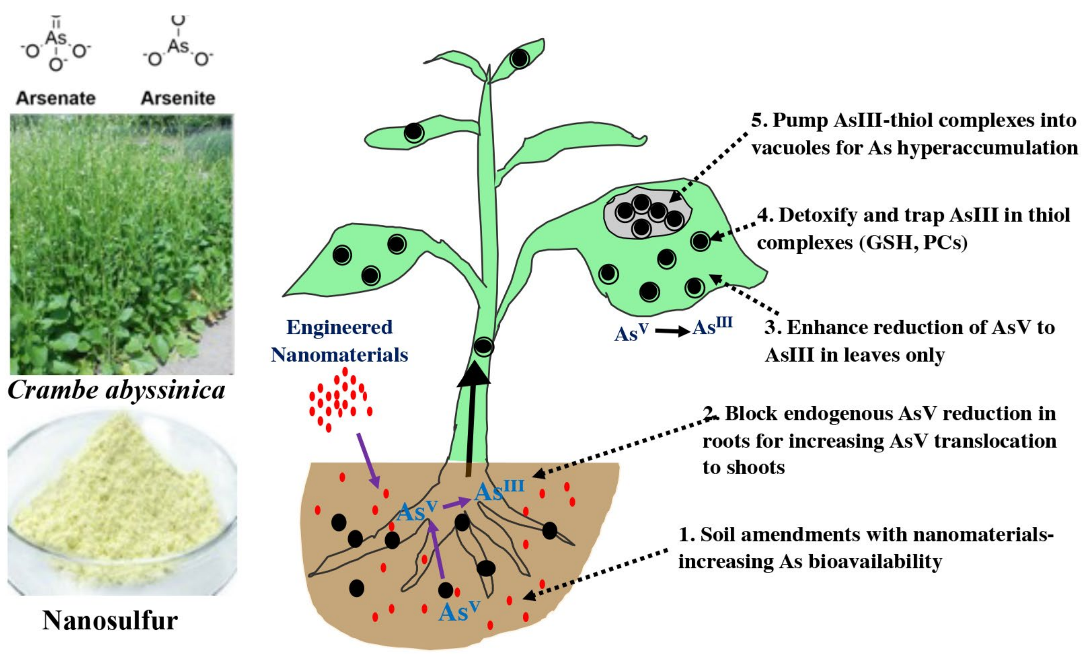
Technology Readiness Level	TRL 3 — Experimental proof of concept TRL 4 — Technology validated in laboratory
Update of Progress	• We are co-expressing four genes that control the transport, oxidation state, and binding of As for efficient extraction and hyperaccumulation into above-ground plant tissues. All four genes are cloned and transformed into *Crambe* either single or stacked genes. • We have already developed transgenic *Crambe* plants for several gene constructs. • Analysis of double transgenic lines coexpressing arsenate reductase and glutathione biosynthesis pathway gene showed that double transgenic plant had significantly increased arsenate (AsV) tolerance as these plants attained almost three-fold higher biomass compared to wild type controls plants. These plants accumulated 2-fold more arsenic in the shoot tissues. Analysis of plants expressing other genes is in progress. • Analysis of transgenic plants for other genes is in progress. • We have also optimized the nanosulfur concentration on arsenic mobility from soil and subsequent uptake and accumulation in *Crambe* grown in soil supplemented with both arsenate and nanosulfur. • Additionally, for the Diversity Supplement award, we are modulating the expression of arsenate reductases for increasing tolerance and reducing As accumulation in rice for food safety.



Developing a genetics-based strategy for arsenic phytoremediation in Crambe abyssinica*, a non-food industrial oilseed crop.*