# AN INTRODUCTION TO MILLETS FROM AROUND THE WORLD

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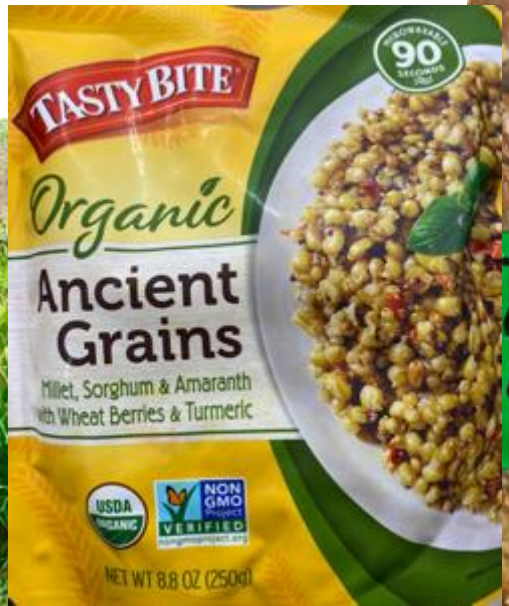
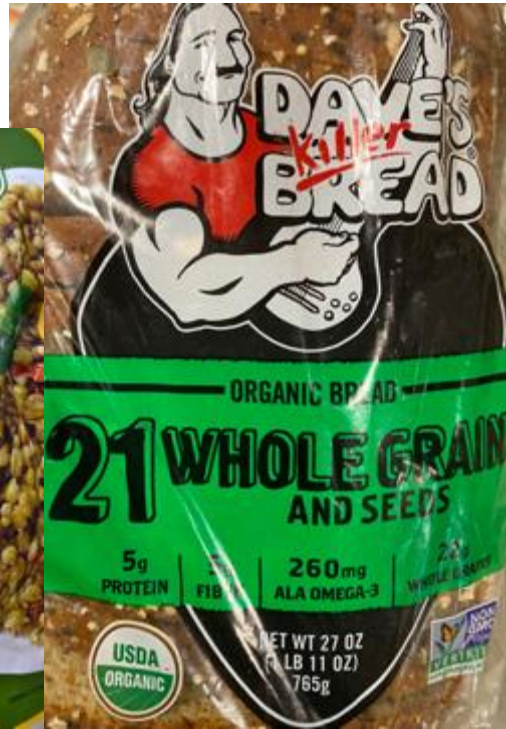
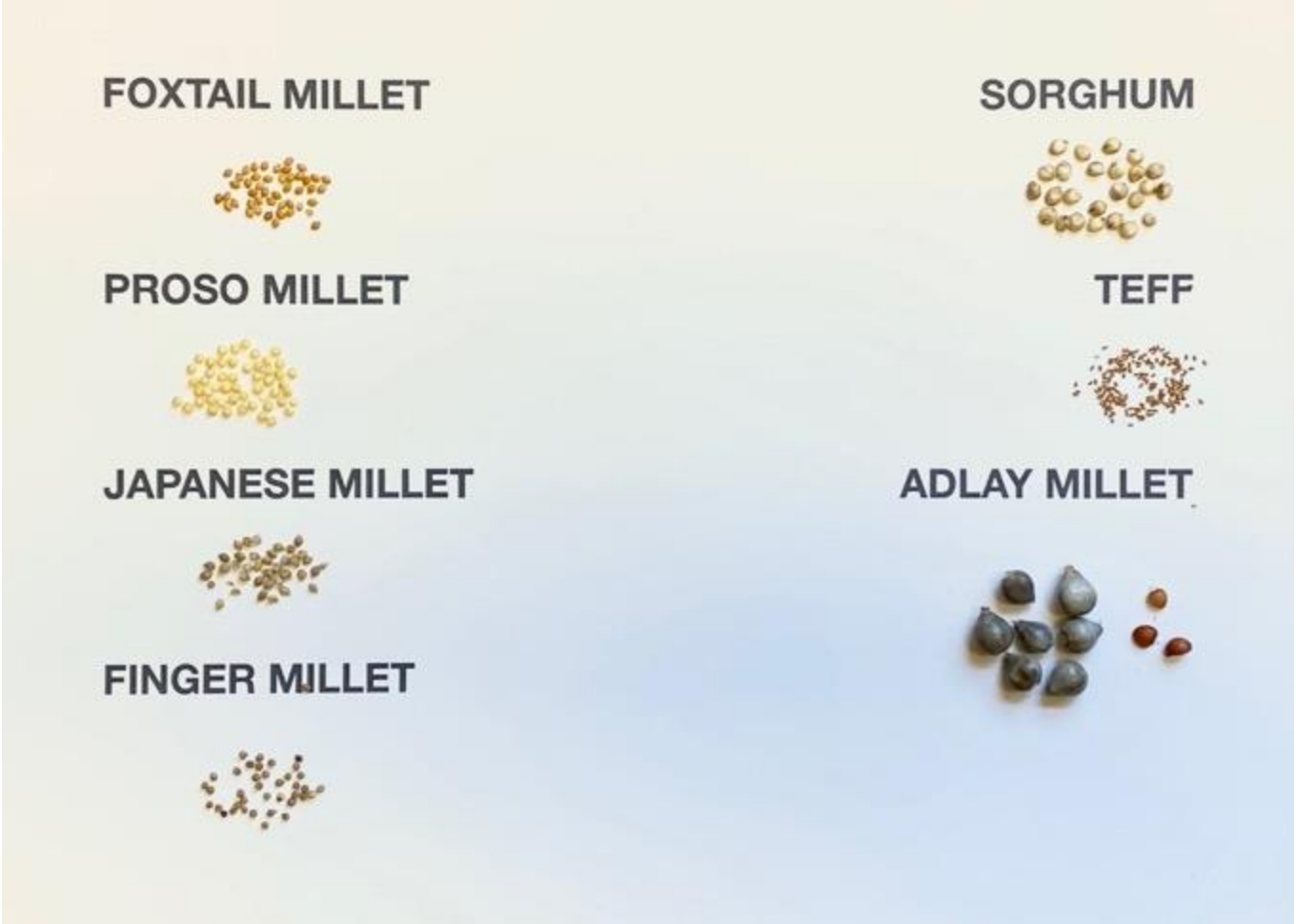
# What are millets?

- Grass crops that grow in summer and produce small rounded seed
- Domesticated for human food, typically sold in multi-grain products
- Sometimes called ”ancient grains”
- Biggest use is in Africa and Asia, some in N. America
- Gluten free



# Millets generally have small rounded seeds



# Annual grasses seed harvested for food

Heavyweights

- Corn (maize)
- Rice

*Warm season*

Cereal grains

- Wheat
- Oats
- Barley
- Rye
- Triticale

*Cool season*

Mid-major millets

- Pearl millet
- Proso millet
- Foxtail millet
- Japanese millet
- Browntop millet
- Finger millet

*Warm season*

Other millets

- Sorghum
- Teff
- Adlay millet
- Kodo millet
- Fonio

*Warm season*

# Why grow millets?


Add biodiversity to cropping systems for economic and ecological benefits, including soil health

# Where do the various millets come from?

| Common name | Scientific name | Areas of origin |
|---|---|---|
| Pearl millet | *Pennisetum glaucum* | African Sahel zone |
| Foxtail millet | *Setaria italica* | East central Asia |
| Proso millet | *Panicum miliaceum* | Central and east Asia |
| Japanese millet | *Echinochloa esculenta* | Southeast Asia |
| Browntop millet | *Urochloa ramosa* | Southeast Asia |
| Finger millet | *Eleusine corocana* | East central Africa |

# Adaptation of millets in the U.S.

| Common name | Typical height, biomass amount | Soil conditions, regions |
|---|---|---|
| Pearl millet | grain-types: 4 feet, med./high biomass<br>forage-types: 6-7 feet, higher biomass | Dry to moderate moisture<br>Southeastern and southern U.S. |
| Foxtail millet | 3-4 feet, medium biomass | Dry to moderate moisture<br>Eastern two-thirds of U.S. |
| Proso millet | 3 feet, low to medium biomass | Dry conditions, High Plains<br>and other parts of Western U.S. |
| Japanese millet | 4 feet, medium biomass | Moderate to high moisture<br>Southeast to central U.S. |
| Browntop millet | 4 feet, medium biomass | Moderate to high moisture<br>Southeast to central U.S. |
| Finger millet | 4-5 feet, medium biomass | Low to moderate moisture<br>Adaptation in U.S. is not well<br>known but does okay in central U.S. |

# A quick survey of individual millet species

# Pearl millet *(Pennisetum glaucum or Cenchrus americanus)*

Also called bulrush millet or cattail millet

Domesticated for food use in Africa

Mainly used as a forage in the U.S. but grain types have been developed that have the highest seed yield of all the millets for U.S. conditions (other than sorghum)

Grain-types are semi-dwarf for easier combining, forage types are taller and best type to use for cover crops

Grain is perfectly edible for people but primarily fed to livestock in the U.S., including chickens

Fun fact – Pearl millet is like a birdfeeder on a stick, certain birds seem to love it!

# Pearl millet is generally planted in wide rows

# Purple ornamental pearl millet

# Proso millet *(Panicum miliaceum)*

University of Nebraska

Also called broomcorn millet, hog millet and common millet

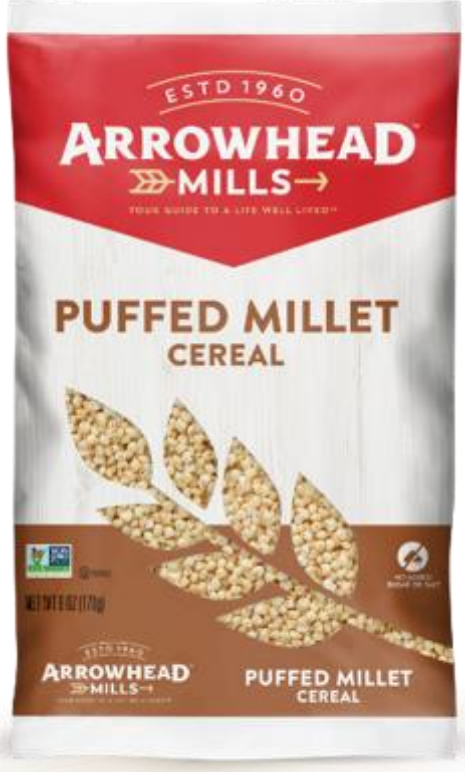
The millet most widely used in foods in North America

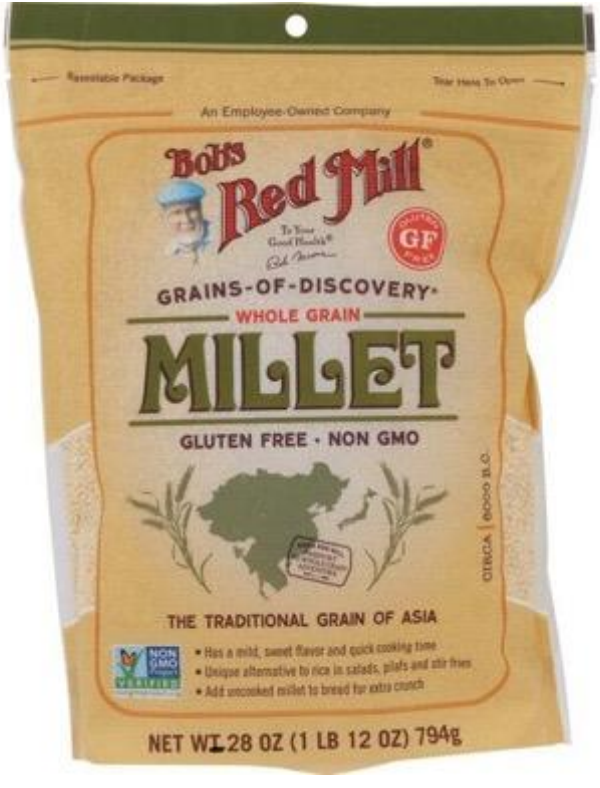
Grown on about 500,000 acres in the High Plains region of western Nebraska, eastern Colorado, Wyoming, Dakotas and Montana

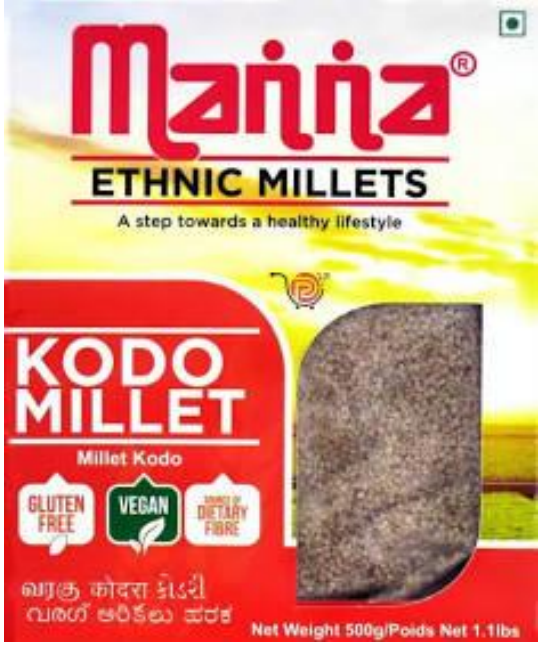
Best adapted to drier, cooler growing regions

Fun fact – Proso millet was probably the first millet domesticated as a human food, around 10,000 years ago!

# Proso millet is the common grocery store millet in the U.S., but other types occasionally sold for ethnic market



# Foxtail millet *(Setaria italica)*




Also called German millet, Italian millet, Hungarian millet, and Siberian millet

Domesticated for food use around 8,000 years ago in China

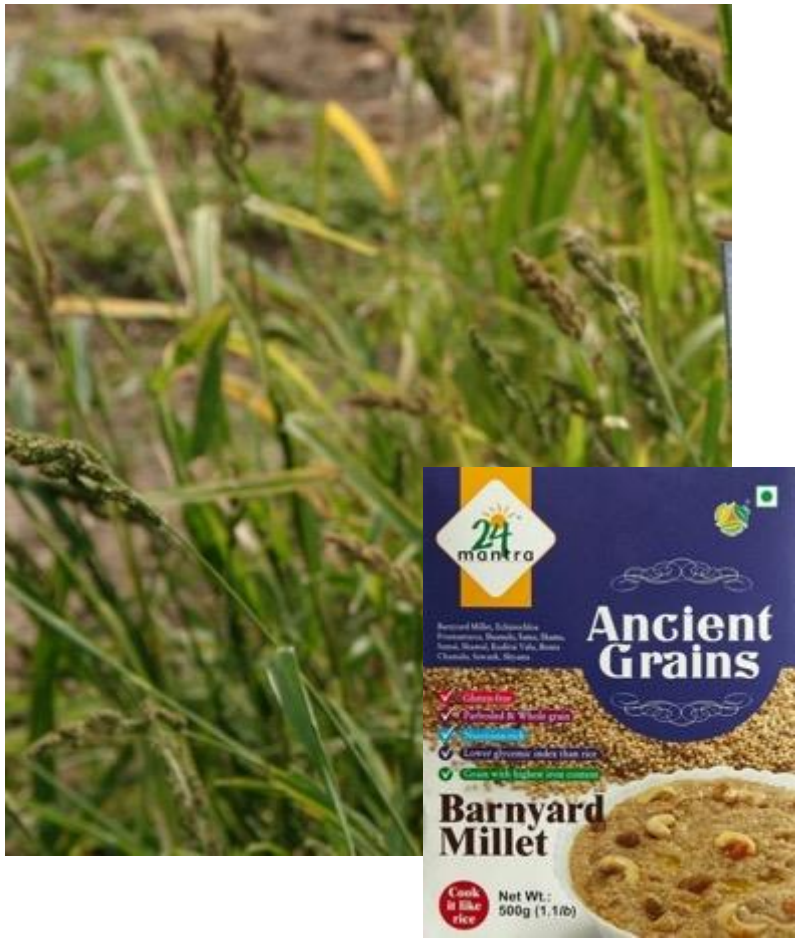
Mainly used as a forage in the U.S., particularly cut for hay

Fast growing and tolerant of dry conditions

Of the millets, the most commonly used as a cover crop, especially after early season vegetables like potatoes

Fun fact - seed “sprays” are cut off and sold for feeding pet birds like parakeets

# Japanese millet *(Echinochloa esculenta)*




Also called barnyard millet

Among the millets, it is most tolerant of wet soils

Popular for wildlife planting to attract ducks, turkeys, and doves

Can grow well in upland sites with average rainfall, does not need wet soils

Fun fact – Japanese millet can even live for awhile in flooded conditions, as long as part of the plant is above water

# Diversity in the Japanese/barnyard millets


Photo from Renganathan Vellaichamy Gandhimeyyan et al. (2022). Barnyard Millet for Food and Nutritional Security: Current Status and Future Research Direction. Frontiers in Genetics 11:500. doi: 10.3389/fgene.2020.00500

# Browntop millet *(Urochloa ramosa or Brachiaria ramosa)*

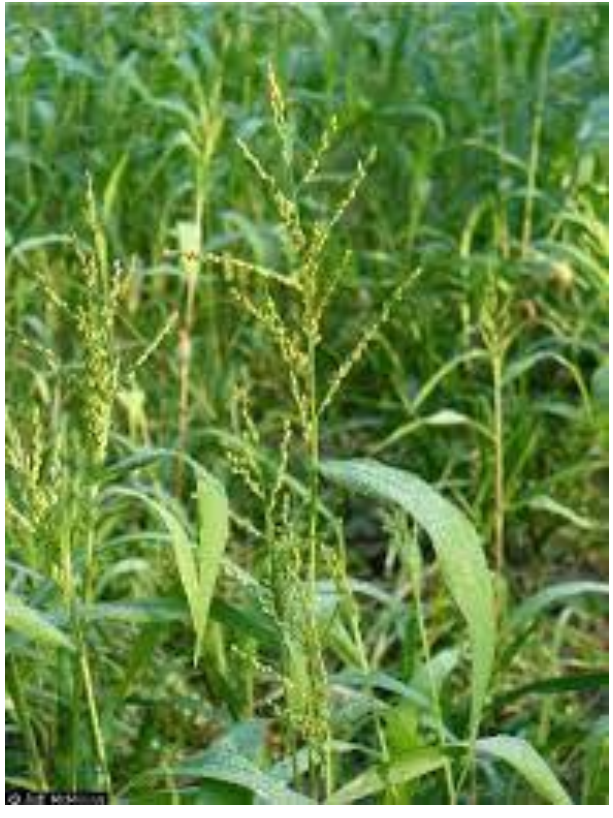


Photo by Jeff McMillian, USDA NRCS database

Also called dixie signalgrass.

Tolerant of damp soils (but not flooded conditions) but also does well in a range of soil moisture conditions and in light textured soils

Mainly used as a forage in the southeastern U.S., also some for wildlife planting

Used some as a cover crop

It was domesticated in southern Indian and is still grown there.

Fun fact - browntop millet is higher in iron content than most other millets.

# Finger millet (*Eleusine coracana)*

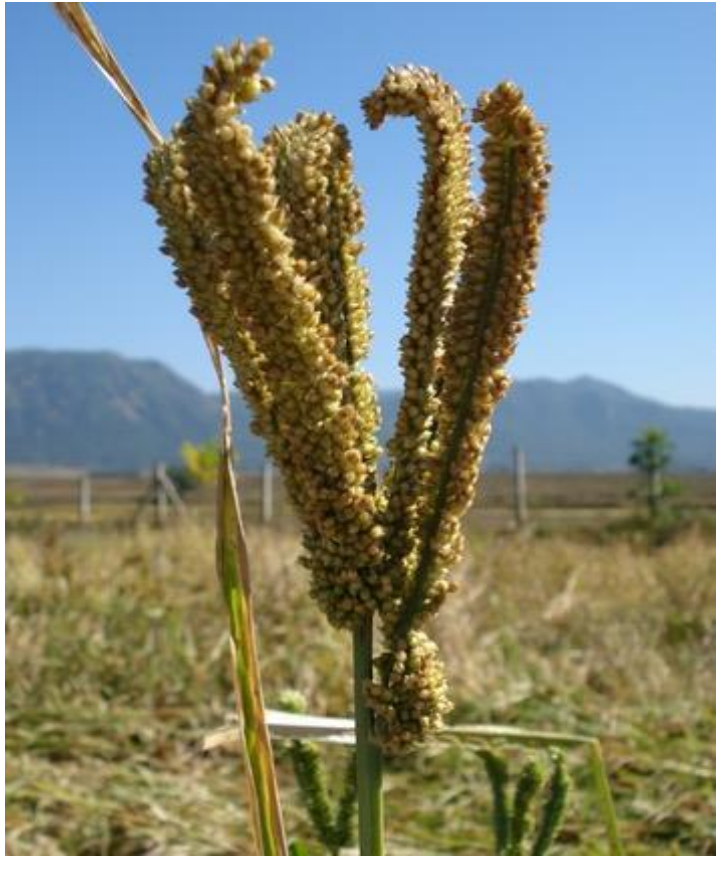


Photo from Neglected and Underutilized Species nus.org

Also called ragi

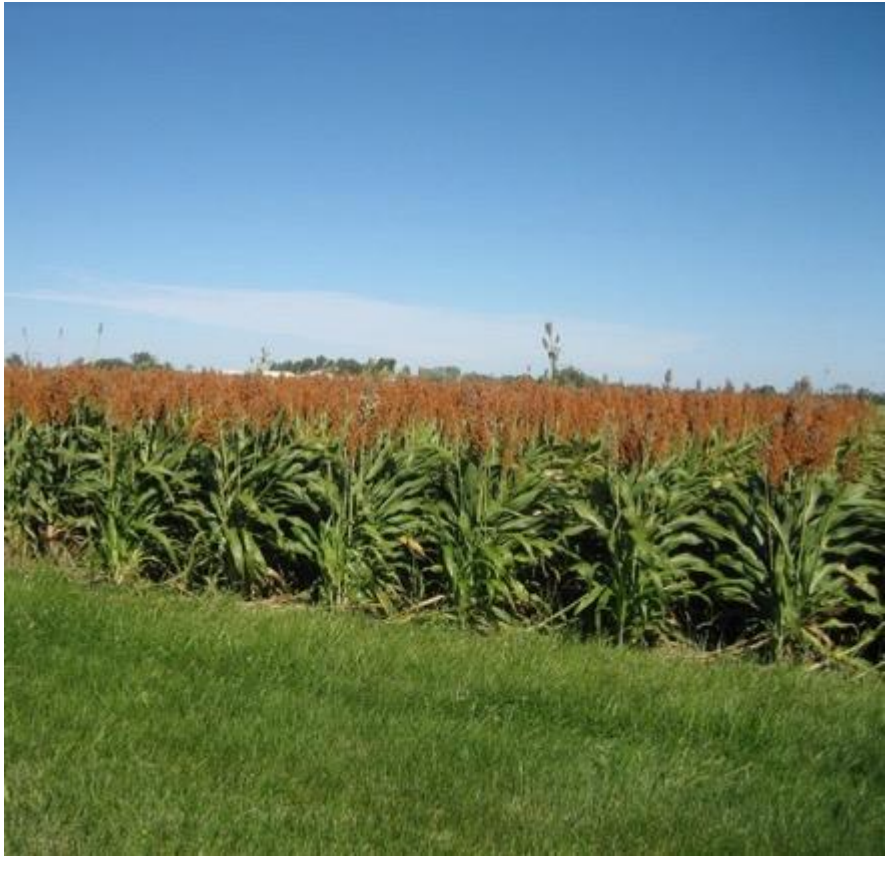
History of use in both Africa and Asia

Significant crop in India where it is a traditional staple food in some regions

Has some beneficial nutritional traits including good iron, calcium and fiber and low glycemic index

Fun fact – Finger millet has unique seed heads with several branching structures like “fingers” that are straight at first and then curl in like fingers closing as the seeds mature

# Sorghum *(Sorghum bicolor)*



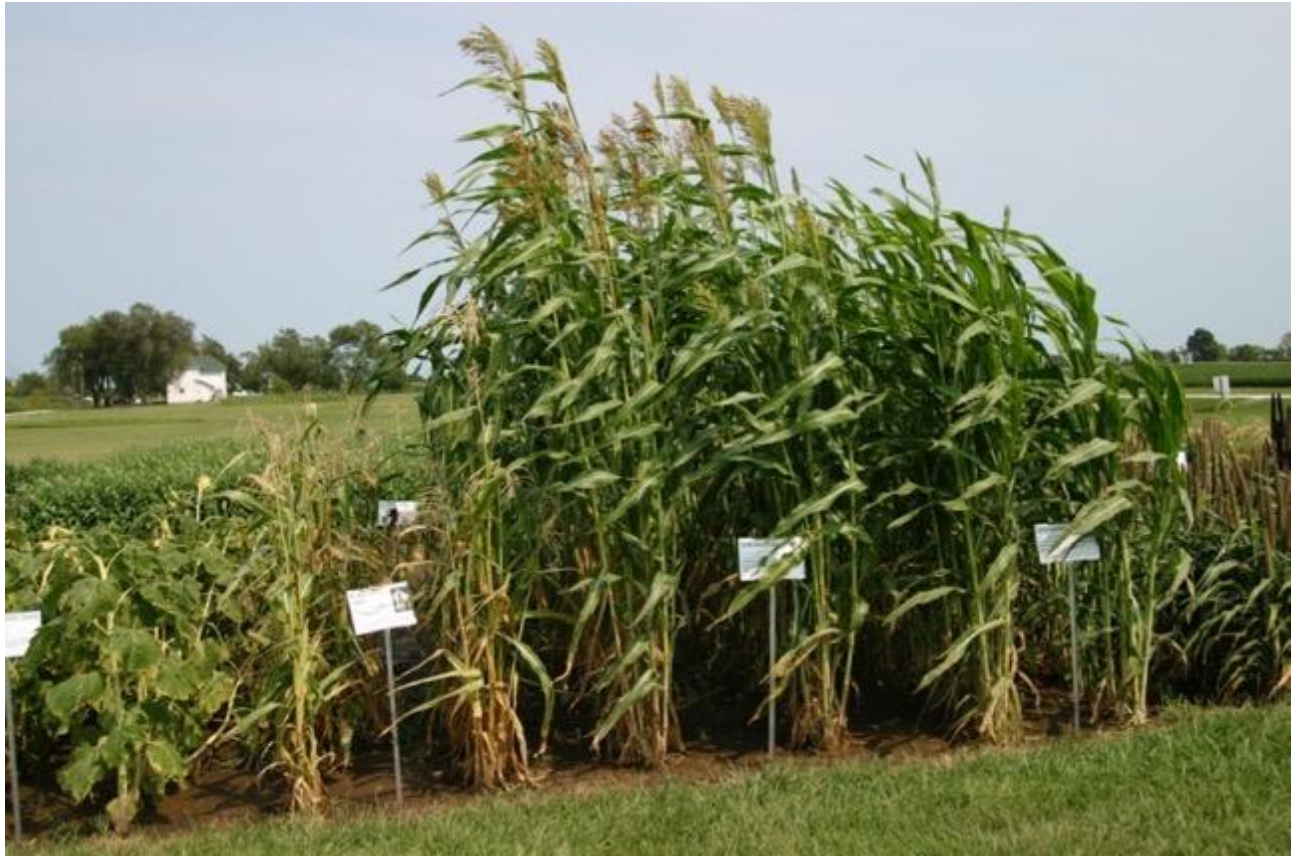
Also called the great millet or milo

One of the major crops in the world, grown on an estimated 70 million acres worldwide and about 5-7 million acres in the U.S. depending on the year

Mainly grown to the south and west of the Corn Belt, as sorghum is better adapted to dry conditions than corn

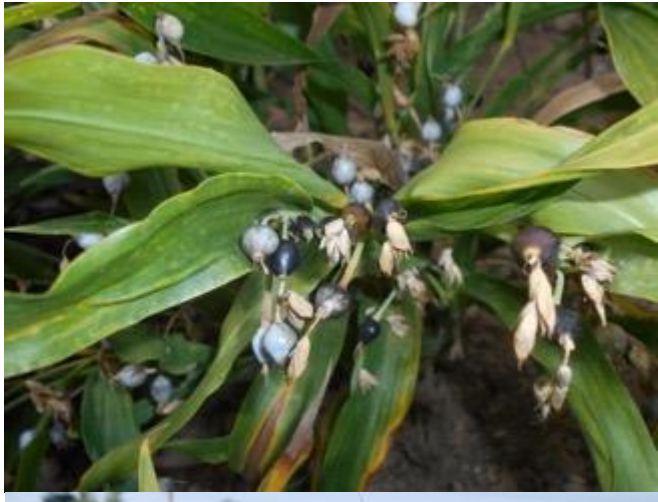
Fun fact – Besides semi-dwarf grain types, there are taller forage types and even taller biomass types up to 15 feet tall. Sweet sorghum has a high sugar content in stem used for sorghum syrups. And there is even a type of sorghum used to make brooms *(Sorghum vulgare)* called broomcorn.

# Biomass and forage types of sorghum



# Other plants sometimes grouped with millets

- Adlay millet, or Job's tears *(Coix lacryma-jobi)*
  - Seeds are inside a hard, rounded fruiting shell (caryopsis) used for jewelry)
- Kodo millet, koda millet, or ditch millet *(Paspalum scrobiculatum)*
  - ➢ Grown in Nepal and India, Phillipines, and West Africa; a noxious weed in the U.S.
- Teff *(Eragrostis tef)*
  - *Native to Africa, particularly grown in Ethiopia*
  - *Used for pancake-like injera bread; a hay crop in U.S.*
- Fonio, or hungry rice *(Digitaria exilis)*
  - ➢ Produces tiny seeds, native to West Africa, grows in tough, dry conditions



# Barriers to further millet production

Buyers want to see easy availability – such as warehouses full of clean product ready to use

Farmers need to gain familiarity

Need to know markets exist and aren't too far away

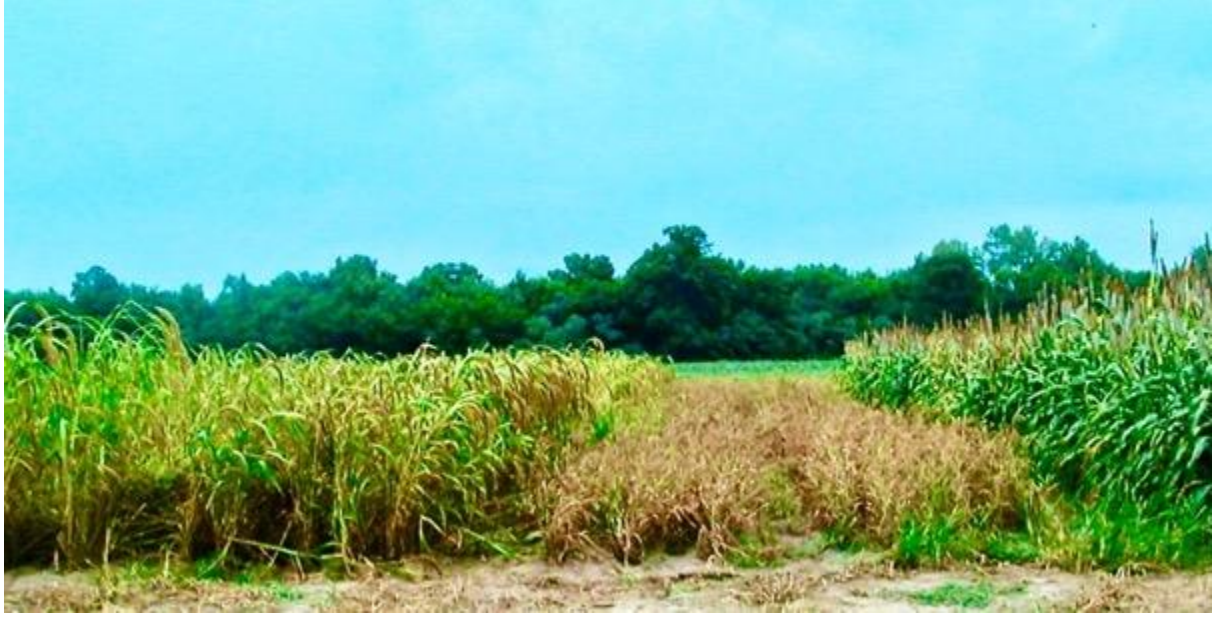
Crop has to be profitable

Need regional adapted varieties and good seed supply

Need infrastructure, such as herbicides and pest control products

Lack of crop insurance

Competes with subsidized crops



# Summary

- Millets have great potential to add to diversity in farming systems
- They provide resiliency for climate change, especially hot dry conditions
- Diverse genetics provide versatility for uses
- Deserve more research, exploration and development