Reuniting the Three Sisters: Native American Intercropping, Seed Saving, and Plant Health

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Introduction

Recent food and seed sovereignty movements within Native American communities have ushered in a revitalization of cultural growing practices. Crucial to this work are efforts to revive knowledge and practices surrounding seed saving, which allow for future plantings of culturally significant crops. This research project, which exists in collaboration with Native American nations and communities throughout the Midwest, has undertaken efforts to conserve and share valued Indigenous varieties. In a Three Sisters Garden plot located at the Horticultural Research Station, in Ames, Iowa, rare indigenous varieties of maize (Zea mays), bean (Phaseolus coccineus), squash (c. maxima), and sunflower (Helianthus annuus) have been grown out for amplification and rematriation.

Rematriation is a rising process within Indigenous seedkeeping networks. This movement, which provides a feminine reframing of repatriation work, seeks to identify cultural seeds from within the collections of non-Native institutions and reunite them with their home communities. For this research to be respectful of the Indigenous methodology utilized by the overarching research project, we decided to grow Native varieties in the garden plot. A culturally appropriate and ethical way to make use of all crops grown for this research was to rematriate the seeds to their home communities. Essential to this process was consulting an advisory board made up of Native growers and seed keepers.

Therefore, a component of our research at this field site is plant health and yield as it relates to seed production. As a continuation of our project from last season, this research considers the effects of the Three Sisters Intercropping of corn, bean, and squash, when compared to each of the crops in monoculture.

Materials and Methods

This project is in its third field season and utilizes many of the methods from the previous season. Experiment layout consisted of a randomized complete block design, with four replications of each treatment [3-sister (3SI), Corn, Bean, Squash)]. Each treatment plot was 6 m x 6 m. Each plot contained 16 mounds, approximately 3ft wide in diameter, per traditional Native gardening methods. Each mound was spaced 5 ft apart (center to center). Mounds were constructed by hand, piling soil into the center of raised beds. Before planting, a composite soil sample from each of the treatments was collected to create a baseline soil nutrient and health profile. Landscape fabric was inserted in between each mound. For the third year (2022) research, a three-year crop rotation was developed for all monoculture treatments: Corn → Squash → Bean → Corn. The 3SI treatment remained in the same research block to allow for analysis of a multi-year treatment effect. Figures 1 and 2 show a 3SI mound and a plot overview, respectively.

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Figure 1. Three Sisters mound with corn, bean and squash at an early vegetation stage.

Figure 2. Side view of bean monocrop plot with sunflower perimeter seen in the background.

Prior to planting, Sustane® Natural Fertilizer (4-6-4), Inc. (Cannon Falls, MN) was applied directly to the growing mounds at a rate of 67 kg/ha. Planting configurations also followed the same protocol as the previous growing season, with a border of sunflowers around the perimeter of the experiment and plants always placed in the same position within each mound, regardless of whether the treatment was a monoculture or the complete intercropping. One adaptation to this year's methods, however, was a reduction in the number of squash planted. Due to competition from plant vigor in the 2020 season, which negatively impacted our bean crop, only two seeds were planted in each mound.

The varieties used in this research are Winnebago Spotted, Scarlet Runner, Red Warren Turban, and Arikara Sunflower. The seed varieties were chosen based on community interest and susceptibility to pervious challenges (ex. smut and bacterial pathogen *Xanthomonas cucurbitae)*. All crops were direct seeded this season, but due to predation, we had to transplant corn in Mid-June. We also had a month delay getting into the field, which pushed the bean and squash planting dates to end of June and early July. The plot relied upon drip irrigation. In the bean monoculture treatments, trellis support was created using wooden stakes and chicken wire to support the vigorous climbing of the Scarlet Runner.

During this season, seed saving was a priority, given the project's aim to produce seeds for rematriation. Sunflower heads were bagged and hand-pollinated to ensure against outcrossing with wild plants. The corn and squash were hand pollinated due to another corn trial occurring less than 305 meters at the Horticulture Research Station and nearby squash plants. Bean plants were open pollinated.

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Results and Discussion

We can't directly compare 2021 and 2022 yields due to the different use of varieties and environmental challenges encountered in the 2022 growing season. We had a month delay in planting and had lower germination percentage for the corn. We also had significant yield loss in squash due to squash vine bore. However, similar trends are common from previous growing season, mainly a higher yield in the monocrop treatment compared to the Three Sisters. Land equivalent ratio has not been calculated for this year nor have statistically significances.

Table 1. Average yield (count and weight) of bean, corn, squash, grown at the ISU Horticultural Research Station from the 2021 growing season.

Treatments	**Monoculture**		**Three Sisters**	
	Count †	**Weight (kg)**	**Count †**	**Weight (kg)**
Maize	114	6.04	107	6.5
Bean	3540	4.6	945	1.27
Squash	103	140.4	78	114.01

Table 2. Average yield (count and weight) of bean, corn, squash, grown at the ISU Horticultural Research Station from the 2022 growing season.

Treatments	**Monoculture**		**Three Sisters**	
Crop	**Count †**	**Weight (kg)**	**Count †**	**Weight (kg)**
Maize	19	0.87	8	0.37
Bean	215	0.81	83	0.47
Squash	21*	6.40	27*	6.89

† Indicates count of pods and ears based on crop.
*Total sum of squash

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