Restoring underutilized Native American food crops
Navajo Spinach, Cleome serrulata & Native Peach

Reagan Wysalucy (Graduate Student), Dan Drost, Brent Black, Grant Cardon, Plants, Soils and Climate Department, Utah State University

Randy Williams; Oral History Specialist, Utah State University Library

Spinach Introduction
• Cleome serrulata has been used as fresh greens and natural dye by the Navajo & Pueblo Tribes.
• Consistent supply could be of benefit as a local source of food and dye.
• This may require managed plantings.
• Germination requirements unknown.

Materials & Methods
Seed collected from 7 locations in NM, AZ, & UT

2018 Germination Treatments
• 4 weeks chilling at 4, 7, or 10°C ±
• ± Promalin® (GA3 & BA); ± Novagib® (GA20); ± MaxCel® (BA); ± Novagib® + MaxCel®; ± H2O2
• Seed soaked for 4 hours
• 25 seeds per rep; 5 replications
• Canyon De Chelly seed source.

Spinach Results
Soaking Trial 2017
• Treatments include GA3+H2O2, H2O2, and No Treatment
• GA3 increased % germination at all temperatures except 20°C
• As temperatures increases, % germination decreases
• Navajo Spinach does not germinate at 20°C
• Increasing chilling time does not improve germination
• Inconsistent T50 and T10/90 between 4 and 8 week trials

Gibberellin Trial 2017

<table>
<thead>
<tr>
<th>TREATMENTS</th>
<th>Temp (°C)</th>
<th>T50 (Days)</th>
<th>T10 50 (Days)</th>
<th>T50 (Days)</th>
<th>T10 90 (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA3 500 + PRO + H2O2</td>
<td>4C</td>
<td>16</td>
<td>15</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>GA3 500 + PRO</td>
<td>4C</td>
<td>16</td>
<td>16</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>GA3 750 + PRO</td>
<td>4C</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>GA3 750 + PRO</td>
<td>7C</td>
<td>13</td>
<td>13</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>GA3 1000 + PRO</td>
<td>7C</td>
<td>16</td>
<td>14</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>GA3 1000 + PRO</td>
<td>10C</td>
<td>16</td>
<td>15</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>H2O2</td>
<td>Control</td>
<td>23</td>
<td>18</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>H2O2</td>
<td>Control</td>
<td>20</td>
<td>13</td>
<td>18</td>
<td>21</td>
</tr>
</tbody>
</table>

• Germination improves when seed are treated with Promalin®
• % germination at 10°C was very low compared to 4°C or 7°C treatments when GA3 used alone.
• Germination uniformity (T10-90) varied by treatment

Discussion
Spinach “Seed Collection Location trial” is on-going to test current conclusions with temperature and hormone treatment effects on all seed sources.

Peach Introduction
First recorded sighting in Southwest by Spanish missionaries in 1619.
Found growing with Pueblo and Navajo Tribes
Seed propagated (Land Race)
Only 2% of original orchards remain

Fruit Characteristics
White free-stone (Most common)
Yellow Free-stone
Small

Uses
Boiled
Fresh
Sundried
Trade goods

Peach Objectives
• DNA analysis to compare Old World peach varieties to Southwest varieties

Seed sources
2 Hopi, AZ
2 Canyon Del Muerto, AZ
Multiple from Navajo Mountain, UT

Dendrochronology
• Compare ring widths with oral histories regarding irrigation management
• Determine life span
• Time period

Discussion
Final results for peach will be Fall 2018.

Genome Mapping
• H2O2 does not break physiological dormancy
• Stratification at 7C more commonly achieves highest germination
• MaxCel® (BA) suppresses seed germination when chilled at 7 & 10C

Hormone Treatments

<table>
<thead>
<tr>
<th>Hormone Treatments</th>
<th>4C</th>
<th>7C</th>
<th>10C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novagib</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Promalin</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>MaxCel +H2O2</td>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>NO TRT</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Hormone Trial 2018

Peach Results

Fruit Qualities
Navajo Mountain, UT White Peach
Calories: 27 Cal
Carbohydrate: 6.8g
Fiber: 1%
Calcium: 11.1mg
Potassium: 129mg
Moisture: 42.6g

Values are per 100g serving size

Oral Histories
• Grown as multi-stem shrub
• No pruning, except removal of dead branches
• No thinning
• Young trees irrigated for <2 years
• Mature trees irrigated by runoff
• Locating historic peach production areas

Hormone Trial

Hormone Treatments

Discussion
Spinach “Seed Collection Location trial” is on-going to test current conclusions with temperature and hormone treatment effects on all seed sources.

Spinach Introduction
• Cleome serrulata has been used as fresh greens and natural dye by the Navajo & Pueblo Tribes.
• Consistent supply could be of benefit as a local source of food and dye.
• This may require managed plantings.
• Germination requirements unknown.

Materials & Methods
Seed collected from 7 locations in NM, AZ, & UT

2018 Germination Treatments
• 4 weeks chilling at 4, 7, or 10°C ±
• ± Promalin® (GA3 & BA); ± Novagib® (GA20); ± MaxCel® (BA); ± Novagib® + MaxCel®; ± H2O2
• Seed soaked for 4 hours
• 25 seeds per rep; 5 replications
• Canyon De Chelly seed source.

Spinach Results
Soaking Trial 2017
• Treatments include GA3+H2O2, H2O2, and No Treatment
• GA3 increased % germination at all temperatures except 20°C
• As temperatures increases, % germination decreases
• Navajo Spinach does not germinate at 20°C
• Increasing chilling time does not improve germination
• Inconsistent T50 and T10/90 between 4 and 8 week trials

Gibberellin Trial 2017

<table>
<thead>
<tr>
<th>TREATMENTS</th>
<th>Temp (°C)</th>
<th>T50 (Days)</th>
<th>T10 50 (Days)</th>
<th>T50 (Days)</th>
<th>T10 90 (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA3 500 + PRO + H2O2</td>
<td>4C</td>
<td>16</td>
<td>15</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>GA3 500 + PRO</td>
<td>4C</td>
<td>16</td>
<td>16</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>GA3 750 + PRO</td>
<td>4C</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>GA3 750 + PRO</td>
<td>7C</td>
<td>13</td>
<td>13</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>GA3 1000 + PRO</td>
<td>7C</td>
<td>16</td>
<td>14</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>GA3 1000 + PRO</td>
<td>10C</td>
<td>16</td>
<td>15</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>H2O2</td>
<td>Control</td>
<td>23</td>
<td>18</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>H2O2</td>
<td>Control</td>
<td>20</td>
<td>13</td>
<td>18</td>
<td>21</td>
</tr>
</tbody>
</table>

• Germination improves when seed are treated with Promalin®
• % germination at 10°C was very low compared to 4°C or 7°C treatments when GA3 used alone.
• Germination uniformity (T10-90) varied by treatment

Discussion
Spinach “Seed Collection Location trial” is on-going to test current conclusions with temperature and hormone treatment effects on all seed sources.

Peach Introduction
First recorded sighting in Southwest by Spanish missionaries in 1619.
Found growing with Pueblo and Navajo Tribes
Seed propagated (Land Race)
Only 2% of original orchards remain

Fruit Characteristics
White free-stone (Most common)
Yellow Free-stone
Small

Uses
Boiled
Fresh
Sundried
Trade goods

Peach Objectives
• DNA analysis to compare Old World peach varieties to Southwest varieties

Seed sources
2 Hopi, AZ
2 Canyon Del Muerto, AZ
Multiple from Navajo Mountain, UT

Dendrochronology
• Compare ring widths with oral histories regarding irrigation management
• Determine life span
• Time period

Discussion
Final results for peach will be Fall 2018.