Clockwise from top left: Photo by Paige Green (1), Photos courtesy of Rezolana Institute (3)

2017 San Luis Valley Hemp Research

FIBERSHED

Local Fiber, Local Dye, Local Labor

Rezolana Institute/Fibershed 2017 Collaboration

Rezolana Institute began working with Fibershed in February by hosting Growing Warriors Executive Director Mike Lewis and assistant (photo at right). During a work session, Mike introduced their designs for hand operated hemp breaks. Prototype models brought by Mike were viewed and operated with options for experimenting with improved versions of the breaks. Rezolana Institute agreed to build both wood and metal roller versions of the break. Two hemp breaks of the improved designs would be built. One pair would be shipped to Growing Warriors and the other would remain for use by Rezolana Institute. The wooded blade break was built first and shipped to Kentucky. The metal roller version was built during early summer. Both new prototypes were tested. Instructions/plans for building the breaks were developed by Rezolana Institute and sent to Fibershed for distribution to future workshop participants.

In addition to building the hemp breaks, Rezolana institute collaborated with Fibershed to plant an acre plot of Industrial Hemp. Mike Lewis was able to assist by obtaining Colorado seed from a grower in Wray, Colorado. Twenty pounds of Futura seeds were used to plant the field. Fibershed assisted with the purchase of compost for the hemp plot and with cover crop seed for five acres. Prior to planting four soil sample were obtained for carbon testing at the UC Berkley lab. Two loads of aged manure were spread in the field and disced into the soil. Planting occurred in late May with harvest in early September (see data documentation sheets for details and weekly monitoring data).

The processing of the hemp stalks with the hand break is promising for small amounts of hemp. In addition to the fiber, waste or shiv resulting from the decortication is being processed for manufacturing earthen blocks composed of soil, stabilizer and hemp shiv. Rezolana Institute presented the results of the block experiments in a paper and presentation for the 2017 Earth USA conference held in Santa Fe in late September. Fibershed assisted with the creation of a poster illustrating the manufacturing process and results of the block trials.

Rezolana Institute, also known as Rezolana Farm, is a community-based operation that is actively engaged in sustainable farming techniques such as keyline plowing and low till agricultural practices. The goal of the farm is to grow heirloom crops, industrial hemp and ancient grain trials within a locally-based low carbon footprint. Most of the farm work is conducted with vintage farming equipment and hand labor for weeding and harvesting. The farm is gradually acquiring infrastructure such as season extender hoop houses, water conveyance systems, composting, and hand operated equipment for hemp processing.

Fibershed has been a key organization in assisting small farmers with small amounts of working capital and other resources essential for Fibershed's work with fiber based natural materials and support for sustainable farming. Overall, 2017 was a very productive and successful collaborative effort with Fibershed and Growing Warriors. The building of the hemp breaks and dissemination of the information to interested groups and cooperatives was far reaching, serving to increase the network of hemp and fiber crop potential for small farms. Rezolana Institute benefits greatly by having active partners and resources to assist with their efforts in promoting sustainable approaches to farming and small scale cottage industries.

2017 San Luis Valley Hemp Seed Trials

PRE-PLANTING DATA

Previous crops and treatments: 2016 Cover crop mix of oats, sorgum, buckwheat, turnip, tillage raddish, peas. Cover crop was previously crimped in the fall of 2016 and left in place as a mulch/ground cover.

Soil test results: Pending UC Berkeley lab analysis, plot soil samples were taken on April 24, 2017

Soil preparation and fertilizer application: 2016 cover crop was crimped in the fall of 2016 with homemade crop roller. 27 cubic yards of aged horse manure was added to the one-acre plot four weeks prior to planting. Moisture in the field plot is good due to winter snows and spring rains. The field was disced after the manure was spread. Planting occurred on May 26, via a vintage Oliver multiple shank 8-foot planter, pulled by a Farmall H tractor. After the planting, furrows were cut into the length of the field for irrigation. Field was flood irrigated for 4 hours by the acequia on May 29th.

Seed germination: Hemp seed germination occurred about a week later, on June 2nd. It appears that nearly 100% of seeds germinated, aside from seeds that were eaten by birds after planting. Each furrow has plants emerging in approximately 7" wide rows from the width of the grain drill shanks.

Planting density: An area of approximately one acre was seeded with 20 pounds of Futura varietal. The planting density is approximately 4 grams of seed for each square foot.

Planting machine: The planting machine is a Oliver, multiple shank, 8 foot model Grain Drill.

Planting date: May 26, 2016. 10:00 am-11:00 am

Planting on May 26, via a vintage Oliver multiple shank 8-foot planter, pulled by a Farmall H tractor

Map 1: Site Plan Map with hemp plot location/boundaries

Data Documentation

Plot Location

The four plots were located near the vicinity of the soil test plots previously established as illustrated on Map 1.

Plot 1: Upper field, rock soil conditions
Plot 2: South edge of plot, upper field
Plot 3: Mid-Field near north boundary
Plot 4: Lower field near south boundary

In the first part of the season

Emergence date of seedlings: June 1, 2017 .

Density of the plants:
Planting occurred on May 26, 2017 with germination occurring a week later around June 1st. Plant density count for test plots occurred on June 19, 2017, approximately a month after planting.

Plot 1: Location: Upper NE #1 / Plant density: 36 plants, 3 rows, 8" apart
Plot 2: Location: Mid SE #2 / Plant density: 38 plants, some in furrow
Plot 3: Location: Mid-field #3 / Plant density: 18 plants, 8" apart on row
Plot 4: Location: Lower SE #4 / Plant density: 20 plants, 8" apart on row

As the season progresses

Male flowering begins – Flowering outside of stations: July 6, 2017
Plots 1, 2, 3, 4: July 17, 2017

Female flowering begins – Plots 1, 2, 3, 4: July 24, 2017

Female seeding begins – Plots 1, 2, 3, 4: August 28, 2017

Once females have mature seed heads

Total Stalk Weight (cut at harvest height) at end of growing season: Approximately 200 KG
Total biomass weight (including roots): not available
Root length: 3" to 8"

San Luis Valley Hemp Seed Trials / Weekly Documentation

	6-19- 17	6-26-17	7-03-17	7-10-17
Time of sunrise	AM 5:43	AM 5:43	AM 5:46	AM 5:49
Time of sunset	PM 8:26	PM 8:25	PM 8:25	PM 8:23
Weather Conditions	Sunny/clear	Clear/sunny	Mostly sunny	Clear/sunny
Temperature in the field	80 F at 10:00 AM	69 F at 9:15 AM	72 F at 9:25 AM	75 F at 9:40 Am
Precipitation/soil moisture	Soil is moist from irrigation	Lt. rain yesterday, surface is moist	Mostly dry, upper field has moisture	Field irrigated 7/9/17
Sunlight	100%	100%	100%	100%
Wind Speed/ Direction	2.5 mph SW	1.4 mph NM	0 mph – calm	1.5 mph NW
New leaf nodes	3 leaf nodes	5 leaf nodes all plants	Upper plant stems of all plants	Upper plant stems of all plants
Distance between leaf nodes	1-1.5"	1-4" range	1-4" range	1-4" range
Number of leaf fingers	3-small, 5-tall	5 for taller plants	5-8	5-9
Average height of plants	3-3.5"	10" overall, some 14"	18" overall, some 24"	20" overall, some 37"
Water use: Acequia or pump (time with well pump on)	Acequia water 6/17/17 for 2 hours	No irrigation	Some unintended minor irrigation at upper tract, dry else	Acequia irrigated 7/9/17 for 2 hours
Did any die?	Few	No	Yellow leafs at lower stems	No
If so, from what?	Over irrigation	NA	NA	NA
Soil mold or fungus on the roots?	Unknown	Unknown	Unknown	Unknown
Insects?	Flies	Flies, moths	Flies, moths, grasshoppers	Flies,moths, grasshoppers,ants, bees
Birds?	None observed in Field	None observed in Field	None observed in Field	None observed in Field

General Observations/Notes:

Field documentation of plots begin on June 19, 2017. The plan sizes at the test plots varies from 2-6". Overall average height of plants throughout the field range from 4-5". Overall, the field is doing well given the minimum tillage practices and addition of aged horse manure. Growth patterns vary according to the terrain, soil conditions and moisture received. Field was irrigated with acequia using 30" furrows to convey the water in the rows. This appears to be a more efficient system of irrigation and flow control of water.

June 26, 2017: Growth of plants over last week has been amazing. There have been warm, hot days with lots of sunshine, peaking at summer Solstice. Overall growth pattern of plants is mapped according to the micro-climate variables or field conditions. Areas where there is good rich soil and manure deposits, the plant growth is notable. Areas at furrows or at head of field where there is much water during irrigation, plant growth is slow or stunted. The plot as a whole has good solar exposure, prevailing SW winds and an improved system of irrigation.

July 3, 2017: Weather has been dry during June. Plants are growing rapidly daily. The west end of the field has the best plant growth, while at the east they are more sparse and smaller in size. This is due to better soil profile at the mid and lower ends while the east section is rocky with very little top soil. A large part of the field has plants with yellow lower leaves, possibly due to hot/dry conditions or excessive moisture during irrigation? Plants at edges of field are doing very well. There is definitely a correlation of plant growth to field micro-climate conditions. Plants now have over 30 days of growth.

July 10, 2017: Weather continues to be sunny in the mornings with afternoon clouds. Temperatures have been in the mid-80s, plant growth has been rapid on a week-to-week basis. Plants have yellow and dry lower leaves. There have been some afternoon showers with only traces of rain. The field was lightly irrigated with the acequia for two hours yesterday. Today the plants look more refreshed. Some male plants are beginning to appear in various places throughout the field. There are distinct growth patterns occurring weekly. Areas where there were generous amounts of manure and better soil profiles seem to correspond to enhanced growth.

San Luis Valley Hemp Seed Trials / Weekly Documentation

	7-17-17	7-24-17	7-31-17	8-7-17
Time of sunrise	AM 5:55	AM 6:00	AM 6:05	AM 6:11
Time of sunset	PM 8:20	PM 8:15	PM 8:09	PM 8:02
Weather Conditions	Sunny, clear sky	Mostly sunny	Mostly cloudy, light wind	Partly cloudy
Temperature in the field	69 F – 9:30AM	77 F – 10:20 AM	67 F – 9:30 AM	61 F – 9:15 AM
Precipitation/soil moisture	Moist ground from rain	Dry ground, no precip recently	Dry ground, no precip recently	Dry ground, no precip recently
Sunlight	100%	100%	60%	100%
Wind Speed/ Direction	2.0 mph NW	2.8 mph NW	3.0 mph SW	2.5 mph SW
New leaf nodes	Upper stems of all plants	Upper stems of all plants	Upper stems of all plants	Upper stems of all plants
Distance between leaf nodes	1-4"	1-5"	1-4"	1-4"
Number of leaf fingers	5, 7	5, 8	5, 8	5, 8
Average height of plants	24", 51" for tall plants	30", 65" for tall plants	36", 80" for tall plants	40", 84-86" for tall plants
Water use: Acequia or pump (time with well pump on)	No flood irrigation, afternoon showers	No irrigation, light rains over last week	No irrigation, light rains over last week	No irrigation, light rains over last week
Did any die?	No	No	No	No
If so, from what?	NA	NA	NA	NA
Soil mold or fungus on the roots?	Unknown	Unknown	Unknown	Unknown
Insects?	Flies, bees, grasshoppers, moths, beetles	Flies, bees, grasshoppers, moths	Flies, bees, grasshoppers, moths, small beetles	Flies,bees, grasshoppers, moths, small beetles
Birds?	None observed	None observed	None observed	None observed

General Observations/Notes:

July 24, 2017: Plant growth over last week has been dramatic. Some taller plants have grown over a foot. Early last week there were a couple of good rains followed with warm clear days. The east end of the field is not doing as well as the west end due to poor soil conditions, excessive water during irrigation and invasive weeds (Canadian milkweed vetch). Numerous male plants are prominent with open pollen sacs for pollination of the female plants. Field edges are doing well with good plant growth.

July 31, 2017: Weather over last week has been variable. Mostly sunny mornings with afternoon clouds and light showers. No measurable amounts of rain have occurred. Plant growth continues at amazing rates. Larger more established plants grow over a foot a week. Male plants ratio to female plants seems less than previous years. The east end of the field remains with smaller plants and is getting overrun with milk vetch. Plants at edges are doing better due to less water in the furrows and less weeds from lack of water.

August 7, 2017: Good growth continues over entire field with most growth occurring at west end of field. There are lots of male plants at various stages of pollination. The tallest plants are at the south and north edges midway in the field. The lower leaves of all plants have turned yellowish, probably indicating that the plants have reached maximum growth.

San Luis Valley Hemp Seed Trials / Weekly Documentation

	8-21-17	8-28-17	8-29-17	9-4-17
Time of sunrise	AM 6:17	AM 6:23	AM 6:29	AM 6:34
Time of sunset	PM 7:54	PM 7:45	PM 7:35	PM 7:25
Weather Conditions	Partly cloudy	Mostly clear	Clear sky	Clear sky with smoke haze
Temperature in the field	64 F – 9:15 AM	61 F – 9:00 AM	65 F – 9:15 AM	71 F – 9:10 AM
Precipitation/soil moisture	No precip, dry surface	No rain, dry soil surface	2 rain showers over last week, moist soil	No rain over last week, dry surface
Sunlight	90%, light haze	90%, high thin clouds	100%, clear sky	100%, clear sky
Wind Speed/ Direction	3.0 mph W	2.0 mph NW	1.0 mph SW	2.5 mph NW
New leaf nodes	Upper stems	No new leaf nodes	No new leaf nodes	No new leaf nodes
Distance between leaf nodes	1-4"	1-4"	1-4"	1-4"
Number of leaf fingers	5-8	5-8	5-8	5-8
Average height of plants	60" with tallest @ 8 foot	60" with tallest @ 8'-6"	60" with tallest @ 8'-8"	60" with tallest @ 8'-10"
Water use: Acequia or pump (time with well pump on)	No irrigation , nor major precip, light rains twice	No irrigation or rain over last week	No irrigation, 2 rain showers over last week	No irrigation, no moisture over last week
Did any die?	No	No	No	No
If so, from what?	NA	NA	NA	NA
Soil mold or fungus on the roots?	unknown	unknown	unknown	unknown
Insects?	Bees, flies, beetles, grasshoppers, moths	Bees, flies, beetles, grasshoppers, moths	Bees, flies, beetles, grasshoppers, moths	Bees, flies, beetles, grasshoppers, moths
Birds?	None observed	None observed	Pidgeons	Some birds at field edge

General Observations/Notes:

August 21, 2017: Day of solar eclipse. Weather is clear with high scattered clouds. No rain over last week. Ground is dry and hard. Plants seem to reached maximum growth and leaves are turning yellow. Male plants are fully visible and distinct and appear to have completed pollination. Female plants are forming seed heads and are dominant in the field. Harvest is anticipated in early September before birds discover the tasty hemp seeds.

August 28, 2017: Two rain showers occurred over the last week and have left the surface of the soil with some moisture. Plants are maturing with majority of plants appearing female forming seed heads. Again, ratio of female to male plants is greater than previous years. The seed heads are feeling sticky and aromatic. Leaves are fading in color, plant growth has stabilized.

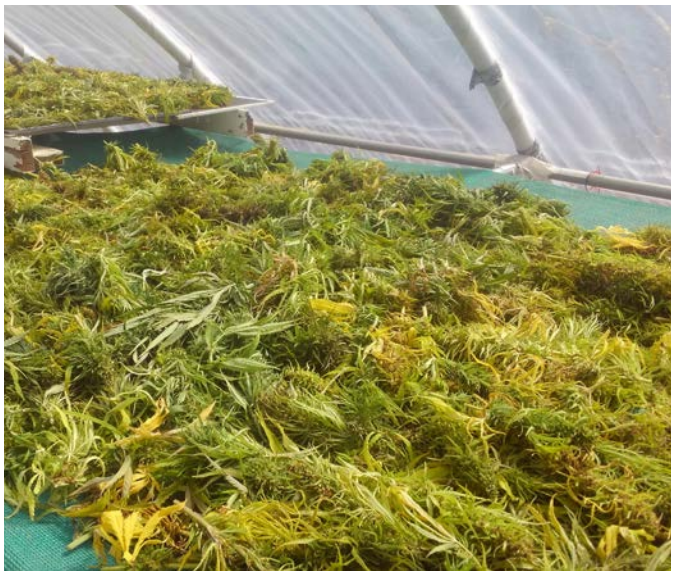
September 4, 2017: Weather has been dry over the week, with no precipitation. Days have been sunny at morning with afternoon clouds. Growth of plants is stable, leaf colors have faded to yellowish green. Seed heads are maturing and may be ready to harvest in a week. The majority of the plants are female. Color of the seed heads varies with some purplish. Resin is also being secreted by seed heads, they are sticky and aromatic.

September 14, 2017: Begin harvesting seed heads, select best ones for harvest. Harvest approximately 100 KG seed pods.

September 15 and 16, 2017: Start Gravely tractor and cut upper third of field. Pick plants by hand and stack piles on ground to be picked up later.

September 17, 2017: Hire neighbor with windrower to finish cutting the remaining plants. In 15 minutes all the plants are cut. They are gathered and laid in piles to be loaded on a truck for hauling.

September 18 and 19, 2017: Plants are loaded on truck and transported to hoophouse for drying and processing for seeds. A bundle of large plants is set aside for dew retting.



Summary of 2017 hemp growing activities

Overall, 2017 was the most successful hemp growing season, partly due to the ease of obtaining a permit from Colorado Department of Agriculture and Colorado-based seed. In the past two growing seasons, obtaining seed was difficult, resulting in seed having to be imported from Europe. The Colorado seed did exceptionally well with good fiber stalks and seed stock. Other factors that contributed to the success was the planting on compost-infused soil and controlling the flow of water by using 30" furrows. The crop provided plenty of stalks for processing into fiber, waste shiv for hemp adobes and enough seed for the 2018 planting season.