San Luis Valley Hemp Research

PARTNERS:
Adams State University • Rezolana Institute • Fibershed

Adams State University
Colorado
Great Stories Begin Here
Community Partnerships

Rezolana Institute

fibershed
local fibers · local dyes · local labor

2015 Overview

The San Luis Valley Hemp Research took place at the Rezolana Institute and was conducted by farm owner and land manager, Arnie Valdez. With the support of Adams State University and Fibershed, the project was able to conduct research on a new varietal, Santhica27, known for its fiber quality. This paper aggregates plant morphology data taken over the course of the 2015 growing season and overviews planting processes and field history.

In addition to focusing on the viability of growing a high quality fiber varietal, the project also initiated a soil-based life cycle assessment for the crop. The soil-based LCA takes a new and holistic approach on carbon accounting by seeking to understand the exchange between atmospheric and on-farm soil carbon levels. The question of our research approach:

> *Can we successfully grow this crop while capturing more atmospheric carbon than we are emitting through our land management, and then appropriate this net negative carbon impact to the raw materials we farm?*

In 2015, the intention was to conduct a no-till organic hemp planting. Due to regulations imposed by the federal level DEA the planting date was delayed. During the delay, the planting area received high levels of precipitation while we awaited the availability of seed. The planting plot began to grow invasive weeds that required tillage prior to planting the hemp. Soil tests will verify what carbon losses or gains occurred during the 2015 planting procedure.

Stalks from 2015 were harvested after the plants had gone to seed. The intention is to understand if stalks that mature to the point of seeding will also provide textile grade fiber. The stalks are being held by the project's technology partner—BastCore—while research is being finalized on the fiber softening system. We will publish a subsequent paper on the process of creating textile grade fiber from the 2015 crop.

2015 San Luis Valley Hemp Seed Trials

PRE-PLANTING DATA

Previous crops and treatments: 2014 Cover crop mix of oats, sorghum, buckwheat, turnip, tillage radish, peas. Cover crop was left in place until the summer of 2015

Soil test results: Pending, soil samples were taken on June 12, 2015 and will be processed at UC Davis for analysis

Soil preparation: The 2014 cover crop was crimped with homemade crop roller on May 26, 2015. A contour survey was conducted on June 15th. One-foot contours were marked to determine elevation drop in the planting plot. The site was plowed on June 21, 2015 in order to eradicate invasive weeds that infiltrated the cover crop. The field was floated on June 22nd. On July 25th the field was plowed in preparation for the planting. Planting occurred on July 25, via a mechanical planter/tractor. No fertilizer or compost was added to the plot.

Seed germination: Hemp seed germination occurred about a week later on August 1st. It appears that nearly 100% seeds germinated.

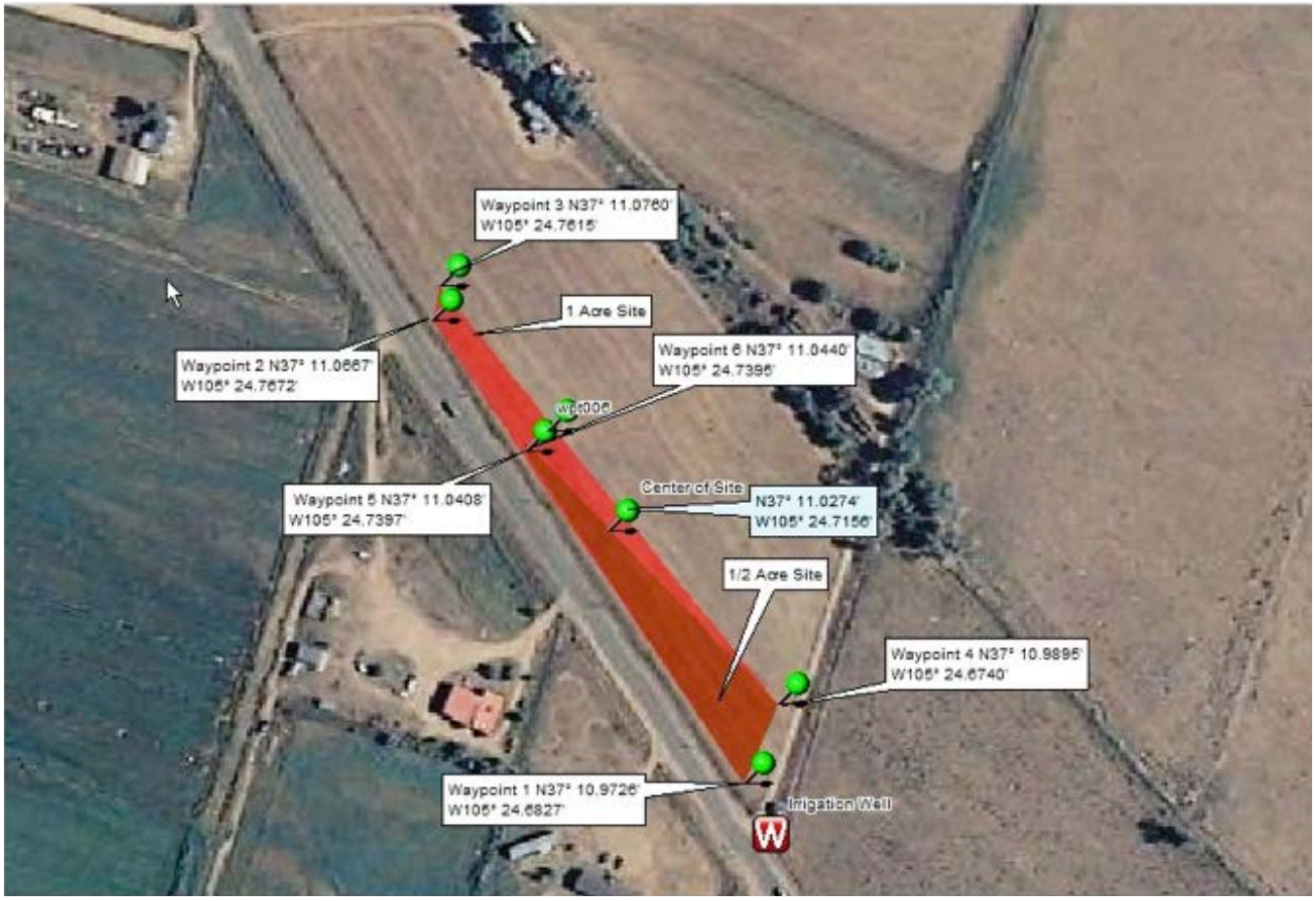
Planting density: An area of 33,541 square feet or approximately .77 acre was seeded with 25 kilograms or 55 pounds of Santhica 27. The planting density is approximately .02 ounces of seed for each square foot.

Planting machine: The planting machine is a TRAUX FLX II-812G Grain Drill. It was an 8-foot model with double disk furrows and independent press wheels.

Planting date: July 26, 2015. 12:00-1:00 PM

Additional notes: The planting occurred at a later date than originally anticipated due to difficulties in acquiring seed from Colorado. Seed was ordered through the Colorado Department of Agriculture.

SITE PLAN SKETCH



Data Documentation

First Week

Designate and mark off four different plots of one square yard each. The four plots were located near the vicinity of the soil test plots previously established.

In the first part of the season

Emergence date of seedlings:
August 3, 2015. Some seeds begin to emerge on August 1st, however three days later all seedlings had emerged. The soil moisture and light rains helped to keep the ground from crusting thus allowing seedlings to break the ground surface.

Density of the plants:
Number of plants in each plot
(counted on August 21)

Plot 1: 48 plants
Plot 2: 73 plants
Plot 3: 133 plants
Plot 4: 92 plants

Irrigation:
The crop was irrigated once from the Acequia on August 13 and 14. After that the only water applied was intermittent rainfall.

Hemp field 1

As the season progresses

Male flowering begins (date):
Plots 1, 2, 3, 4: September 14, 2015

Female Flowering begins (date):
Plots 1, 2, 3, 4: September 21, 2015

Female seeding begins (date):
Plots 1, 2, 3, 4: October 1, 2015

Once females have mature seed heads

Total Stalk Weight (cut at harvest height) at end of growing season:
Approximately 25 Kilograms were harvested. This harvest was for plants ranging in size from 18 inches to 48 inches representing about 5 % or less total harvest area. The majority of the plants ranged from a few inches to 18 inches, attributed to short growing season.

Total biomass weight (including roots):
The harvest volume was approximately 36 cubic feet, green weight was estimated at 25 KG or 55-60 pounds.

Root length:
The root length ranges from 2 inches for the smaller plats to 6 inches for the larger plants. Round nodules were noticed at the base of the stalks where the root are formed.

Photo of the root patterns:

San Luis Valley Hemp Seed Trials / Weekly Documentation

(Choose the same day each week)

	8-24-15	8-31-15	9-7-15	9-14-15
Time of sunrise	6:25 AM	6:30 AM	6:36 AM	6:42 AM
Time of sunset	7:44 PM	7:34 PM	7:24 PM	7:13 PM
Weather Conditions	Hazy sky	Partly cloudy	Partly cloudy	Partly cloudy
Temperature in the field	69 deg-10:20 AM	73 deg-10:15 AM	56 deg-10:05 AM	65 deg-10:10 AM
Precipitation/soil moisture	Station 1-16 %	Station 1-14%	Station 1-15%	Station 1-11%
Sunlight	100%	96%	98%	65%
Wind Speed/ Direction	Not Available	Not Available	Not Available	Not Available
New leaf nodes	Top of 5" plants	Upper plant Stalks	Upper plant Stalks	Upper plant Stalks
Distance between leaf nodes	¾- ½ inch	2-3"	2" up to 3" on larger plants	1-2"
Number of leaf fingers	3-4	3-5	5	5-7
Average height of plants	5 " some at 9"	8" some at 20"	15" some at 30-41"	20" some at 48"
Water use: Acequia or pump (time with well pump on)	Light rain shower yesterday	No irrigation, trace shower last week	2-3 light rains for short duration last wk	No precipitation last week
Did any die?	Few plants near roadway	No	No	No
If so, from what?	Vehicle traffic, irrigation channels	NA	NA	NA
Soil mold or fungus on the roots?	Unknown	Unknown	Unknown	Unknown
Insects?	Flies, ants, bees	Flies, ants, bees	Flies, ants, bees	Flies, ants, bees
Birds?	Pigeons	Pigeons, Blackbirds	Pigeons, Blackbirds	Pigeons, Blackbirds

General Observations/Notes:

Field observations and documentation began on August 24, 24 days from when the seedling emerged from the surface of the ground. The entire crop was irrigated with acequia water on August 13-14th. Although the plants appeared dry and there had been a lack of rain they were doing fine just on the ground moisture. The flood irrigation early in the plant growth cycle appears to have led to the plants being stunted and subsequently many turned to a lighter shade of green. The plants that grew faster with a darker green color, are those that received little water and were located on the upper sections of raised ground.

San Luis Valley Hemp Seed Trials / Weekly Documentation

(Choose the same day each week)

	9-21-15	10-1-15	10-8-15	10-13-15
Time of sunrise	6:47 AM	6:55 AM	7:02 AM	7:06 AM
Time of sunset	7:02 PM	6:47 PM	6:36 PM	6:29 PM
Weather Conditions	High, thin clouds	Partly cloudy/sunny	High, thin clouds, lt wind	Clear sky, first light frost
Temperature in the field	86 deg-10:08 AM	82 deg-12:50 AM	59 deg-10:12 AM	68 deg-1:00 PM
Precipitation/soil moisture	Station 1-11 %	Station 1-12%	Station 1-12%	Station 1-11%
Sunlight	100%	100%	82%	100%
Wind Speed/ Direction	4 MPH/southwest	1.5mph/west/SW	3-4 mph/west/SW	2-3 mph/west/SW
New leaf nodes	Upper plant Stalks	No new leaf nodes observed	No new leaf nodes observed	Plants harvested at 24-50 inches tall
Distance between leaf nodes	¾- 1 inch @ tops			
2-3" between	2-3" at upper stalks	No new leafs, seed clusters forming	No new leafs, seed clusters	
Number of leaf fingers	5-7	7	7	7
Average height of plants	22 " some at 40"	24" some at 20-50"	15-24" some at 14-48"	10-24" plants unharvested
Water use: Acequia or pump (time with well pump on)	No precipitation			
Last week	2 light rains over last week, less that ¼"	Trace amounts of rain over last week, less than ¼"	No precipitation 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, ants, bees	Flies, ants, bees	Flies, ants, bees	Flies, ants, bees
Birds?	Pigeons	Pigeons, Blackbirds	Pigeons, Blackbirds	Pigeons, Blackbirds

General Observations/Notes:

10-01-15. Plants have reached maximum height and are now in full maturation stage. Female plants are developing seedpods, male plants are less in number and beginning to change color and wilting indicating that pollination is complete. Flowering plants are attracting honeybees. The largest stand of hemp plants is at the west end of the plot near station 4. Plants range in height from 36-52 inches. The mature larger plants were harvested on October 13, 2015.

Soil sample map

Field retting

Further Research

QUESTIONS AND AREAS OF FOCUS

1) In 2016, the project will conduct a no-till hemp planting; soil carbon samples will be taken using the same methodology on both the no-till plot, as well as the plot that was tilled in 2015. Soil sampling is being taken in an effort to compare the carbon consequences of no-till vs. tillage in hemp agriculture.

2) In 2016, the project will plant 50kg/acre of hemp seed in late May. The intention of the planting date is to determine what kind of biomass and seed yields are possible when the crop is able to begin growing one month prior to the solstice (the plant is day length sensitive and goes to seed quickly when the day length shortens).

3) The project will continue to harvest and prepare stalk for textile grade fiber research. A subsequent paper will cover the details of this research.