

2016 San Luis Valley Hemp Research



PARTNERS:

Adams State University • Rezolana Institute • Fibershed



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, Fibershed and The Colorado Department of Agriculture. Working with the Department of Agriculture, Fibershed secured a European fiber varietal known as Santhica27. This paper aggregates plant morphology data taken over the course of the 2016 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 has continued its effort to develop 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.

2016 San Luis Valley Hemp Seed Trials

PRE-PLANTING DATA

Previous crops and treatments: 2015 Cover crop mix of oats, sorghum, buckwheat, turnip, tillage raddish, peas. Cover crop was previously crimped in the fall of 2014 and left in place as a mulch/ground cover.

Soil test results: Pending UC Davis lab analysis, plot soil samples were taken on April 10, 2016

Soil preparation and fertilizer application: 2015 cover crop was crimped in the fall of 2014 with homemade crop roller. 27 cubic yards of aged horse manure was added to the one-acre plot four weeks prior to planting. Field was flood irrigated for 12 hours by the acequia on May 5th. Planting occurred on May 25, via a vintage Case single disc 14-foot planter pulled by a Farmall H tractor. No till approach adopted for this year.

Seed germination: Hemp seed germination occurred about a week later in early June (note: germination consistent with last year's late planting). It appears that nearly 100% seeds germinated, aside from seeds that were eaten by birds after planting.

Planting density: An area of approximately one acre was seeded with 50 kilograms or 110 pounds of Santhica 27 varietal. The planting density is approximately .04 ounces of seed for each square foot.

Planting machine: An area of approximately one acre was seeded with 50 kilograms or 110 pounds of Santhica 27 varietal. The planting density is approximately .04 ounces of seed for each square foot.

Planting date: May 25, 2016. 10:00 AM-12:00 PM

Additional notes: Several trial adjustments were made on the grain drill speed to check for seed dispersal. After starting with a low speed for half the field and watching the seed hopper, the speed was increased slightly and left at a setting comparable for grain seeding. After the field was drilled there was still seed remaining in the hopper so additional runs were made in the field to finish all the seeds.



SITE PLAN SKETCH



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



Collecting soil samples for testing

Data Documentation

Plot Location

The four plots were located near the vicinity of the soil test plots previously established as illustrated on Map 1. The location for each of the plots was in response to the micro-climate conditions of the site. Plot 1 was located at the mouth of a heavily flood area; Plot 2 is located south-central at a high spot; Plot 3 was located near the northern edge, higher water flow; and Plot 4 was located in the lower/northwest edge of plot at a high spot with water flow around the plot.

In the first part of the season

Emergence date of seedlings: June 1, 2016.

Density of the plants:

Planting occurred on May 25, 2016 with germination occurring a week later around June 1st. Plant density count for test plots occurred on June 20, 2016, approximately a month after planting.

Plot 1: Located in the upper central portion of the plot field. This are is located in a low are that receives large flows of irrigation water. Density of plants was 145 plants. Other competing plants include: cheat grass, oats, and several other noxious weeds that need to be identified.

Plot 2: Located in upper south/middle of plot field. Plant density was 82 plants. Other competing plants include: oats. Lambs quarters, sunflowers, clover. Peas, tomato weed. The weeds are larger than hemp plants in this plot.

Plot 3: Located in north/central edge of plot field. Plant density was 88 plants. There are three distinct rows of hemp plants at approximately 8 inches apart. Other competing plants include: sunflower, oats, grey weed, lambs quarters.

Plot 4: Located in lower north edge of field. Plant density at 64 plants. Other competing plants include: lambs quarters, tomato weed, oats.

As the season progresses

Male flowering begins – Plots 1, 2, 3, 4: July 19, 2016

Female flowering begins – Plots 1, 2, 3, 4: August 22, 2016

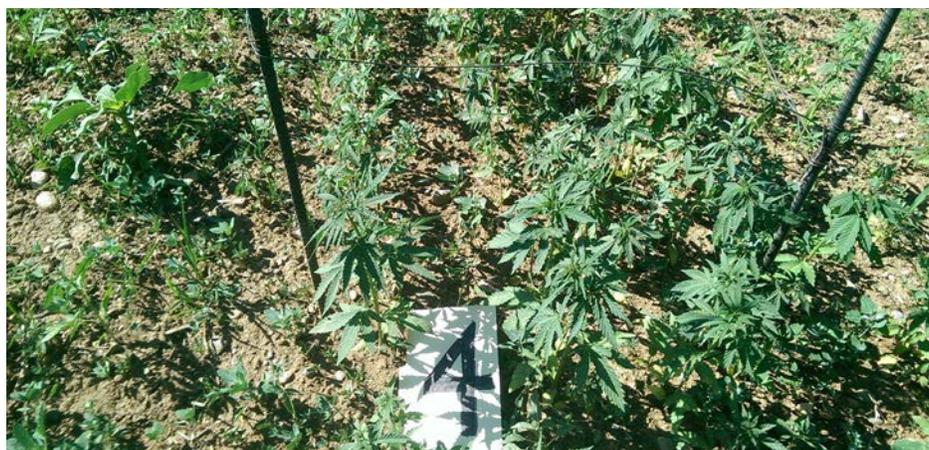
Female seeding begins – Plots 1, 2, 3, 4: August 29, 2016

Once females have mature seed heads

Total Stalk Weight (cut at harvest height) at end of growing season: Approximately 20 KG

Total biomass weight (including roots): 20 KG

Root length: Varies from 1" to 4" for larger plants



San Luis Valley Hemp Seed Trials / Weekly Documentation

	6-20-16	6-28-16	7-04-16	7-11-16
Time of sunrise	5:41 AM	5:44 AM	5:46 AM	5:50 AM
Time of sunset	8:25 PM	8:26 PM	8:25 PM	8:24 PM
Weather Conditions	Mostly Clear/ light haze	Clear with scattered clouds	Clear with scattered clouds	Clear, light wind
Temperature in the field	76 degrees @ 10:05 AM	74 degrees @ 9:15 AM	65 degrees @ 10:15 AM	75 degrees @ 10:20 AM
Precipitation/soil moisture	No precipitation, dry soil surface	Light rains over last week, dry soil	Light rains over last week, soil is moist	No precip., plot was irrigated 7-10
Sunlight	100%	100%	100%	100%
Wind Speed/ Direction	2 mph-SW	2.8 mph-NORTH	2.5 mph-WEST	5 mph-SW
New leaf nodes	Noted at taller plants	All upper stalks	Upper stalks	Upper stalks
Distance between leaf nodes	1-2.5" to 3"	1" to 3"	3" to 4"	3" to 4"
Number of leaf fingers	3 for small plants, 5 for tall plants	3 for smaller plants	5 at upper stalks, 3 at lower stalks	5 at upper stalks, 3 at lower stalks
Average height of plants	Varies from 1" to 6"	1" to 14"	2" to 24" range of heights	3" to 30" range of heights
Water use: Acequia or pump (time with well pump on)	Field was watered with acequia on June 11/12th	No irrigation, trace shower last week	2-3 light rains for short duration last week	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	Flies, grasshoppers,	Flies, moths, butterflies, bees, grasshoppers	Flies, moths, butterflies, bees, grasshoppers
Birds?	None observed	None observed	None observed	Blackbirds

General Observations/Notes:

July 11, 2016: Taller plants are beginning to show signs of gender. Plants with darker green color are healthier and more vibrant. There are numerous yellowish/green plants that are smaller or may have been stunted in growth by excessive moisture via flood irrigation. Each of the test stations has varying degrees of plant growth and mixes with cover crop and noxious weeds. The fourth station at the lower field has the best plants in terms of size, color and structure.

San Luis Valley Hemp Seed Trials / Weekly Documentation

	7-19-16	7-25-16	8-01-16	8-8-16
Time of sunrise	5:56 AM	6:01 AM	6:06 AM	6:12 AM
Time of sunset	8:20 PM	8:16 PM	8:10 PM	8:03 PM
Weather Conditions	Mostly clear with scattered clouds	Clear with high thin clouds	Partly cloudy	Clear with high thin clouds
Temperature in the field	76 degrees at 10:00 AM	74 degrees at 9:00 AM	68 degrees at 10:00 AM	70 degrees at 10:30 AM
Precipitation/soil moisture	No precipitation over last week, dry	No precipitation, hard dry surface	Lt rain overnight, otherwise dry	Lt rain overnight, dry, hot surface
Sunlight	100%	100%	95%	100%
Wind Speed/ Direction	5 mph-NE	3 mph-WEST	2.5 mph-WEST	2 mph-SW
New leaf nodes	Upper plant stalks	Upper plant stalks	No new leaf nodes on smaller plants	No new leaf nodes on smaller plants
Distance between leaf nodes	1"-5"	1"-3"	1"- 3"	1" - 3"
Number of leaf fingers	3 for small plants, 5 for taller plants	3-5 for small plants, 5-7 for taller plants	3-5 for small plants, 5-7 for taller plants	3-5 for small plants, 5-7 for taller plants
Average height of plants	15" with range of 3-27" plants	17" with range of 3-30" plants	18" with range of 3-48" (male plants)	18" with range of 3-48" (male plants)
Water use: Acequia or pump (time with well pump on)	No water applied, no precipitation	No water applied, no precipitation	Light rain overnight	Light intermittent rains
Did any die?	No	Yes	Yes	Yes
If so, from what?	NA	Lack of moisture	Lack of moisture	Lack of moisture
Soil mold or fungus on the roots?	Unknown	Unknown	Unknown	Unknown
Insects?	Moths, butterflies, bees, grasshopper, flies			
Birds?	None observed	Non observed	Blackbirds, wrens	None observed

General Observations/Notes:

July 19, 2016: Male plants are distinct throughout field. There are larger clumps at the west end of the field and along north boundary where soil was disc-ed. The majority of the plants in the plot have suppressed growth due to compacted soil, residual cover crop and invasive weeds. Some weeds may have come from the horse manure possibly?

July 25, 2016: Male plants are beginning to open pollen sacks. Tallest plants at north edge are approximately 36" tall and predominantly males.

August 1, 2016: Weeds and oats have overrun the hemp plot, noxious weeds and residual cover crops are seeding. Mechanical termination at east end of plot via sickle mower has begun in order to control the weeds from maturing. Male and female plants seem to be reaching full maturity.

San Luis Valley Hemp Seed Trials / Weekly Documentation

	8-15-16	8-22-16	8-29-16	9-5-16
Time of sunrise	6:18 AM	6:24 AM	6:31 AM	6:37 AM
Time of sunset	7:55 PM	7:46 PM	7:34 PM	7:24 PM
Weather Conditions	Mostly clear with light high clouds	Overcast, with partly sunny skies	Partly cloudy	Mostly clear, some clouds at horizon
Temperature in the field	69 degrees at 9:45 AM	59 degrees at 9:30 AM	60 degrees at 9:50 AM	65 degrees at 10:00 AM
Precipitation/soil moisture	Surface is moist from irrigation	No precipitation, dry soil surface	Short overnight rain, ground surface moist	Short rains overnight, dry ground
Sunlight	100%	50% partly cloudy	45% partly cloudy	100%
Wind Speed/ Direction	2 mph NW	6 mph S/SE	1.5 mph -SW	5 mph-SW
New leaf nodes	NONE	NONE	NONE	NONE
Distance between leaf nodes	1"-5"	1"-5"	1"-5"	1"-5"
Number of leaf fingers	7 for upper, 5 for lower stalks	7 for upper, 5 for lower stalks	7 for upper, 5 for lower stalks	7 for upper, 5 for lower stalks
Average height of plants	16" overall	16" overall	16" overall	16" overall
Water use: Acequia or pump (time with well pump on)	Hours	No irrigation or precipitation	Light rains over last week, less than .05" total precipitation	Light rains over last week
Did any die?	Yes	Yes	No	No
If so, from what?	Lack of water	Lack of water	NA	NA
Soil mold or fungus on the roots?	Unknown	Unknown	Unknown	Unknown
Insects?	Bees, flies, grasshoppers, beetles	Bees, flies, grasshoppers, beetles	Bees, flies	Bees, flies
Birds?	Few sparrows	Blackbirds, pigeons, sparrows	Non observed	Non observed

General Observations/Notes:

August 15, 2016: 2/3 of field has been mowed down to mitigate invasive weeds and residual cover crop vegetation. Larger mature female plants can be found at the west and north boundaries of the field. Both male and female plants are maturing. Male plants have pollinated female plants that are forming seed pods.

August 29, 2016: Female plants are mature with seed pods, it appears that there has been some damage to some seed heads, most likely from birds.