Rhodes Grass & Industrial Hemp as Potential Alternative Crops of the Low Desert

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The Rhodes Grass: alternative forage crop?

- ✓ Backgrounds
- ✓ Research @ DREC
- ✓ Yield & nutrition
- ✓ Agronomic features
- ✓ Summary

Background

- Rhodes Grass (*Chloris gayana* Kunth, *C. abyssinica* Hochst (synonym)
  - ✓ A perennial grass native to Africa, but, widespread in tropical & subtropical countries.
  - ✓ Very closely related to Bermuda grass (*Cynodon dactylon*) &
  - ✓ can grow in many types of habitat

The DREC Research Project;

Tested 2 varieties;

- ✓ the 1st of its kind, here in CA
- ✓ *Gulfcut (GF)* & *Recliner (RL)* for adaptability, forage yield & nutrient compositions
- ✓ Trial plots laid out as RCBD with 4 replication

Planting

- 18 lbs of seeds/ ac
- Seeds broadcasted
- sprinkler irrigation, then flood

Newly germinating Rhodes grass field

- Fertilizers;
  - ✓ 120 lb/ac N (pre-plant) & 50 kg/ac N at subsequent cuttings
  - ✓ Pre-plant PK at 40-50 kg/ac

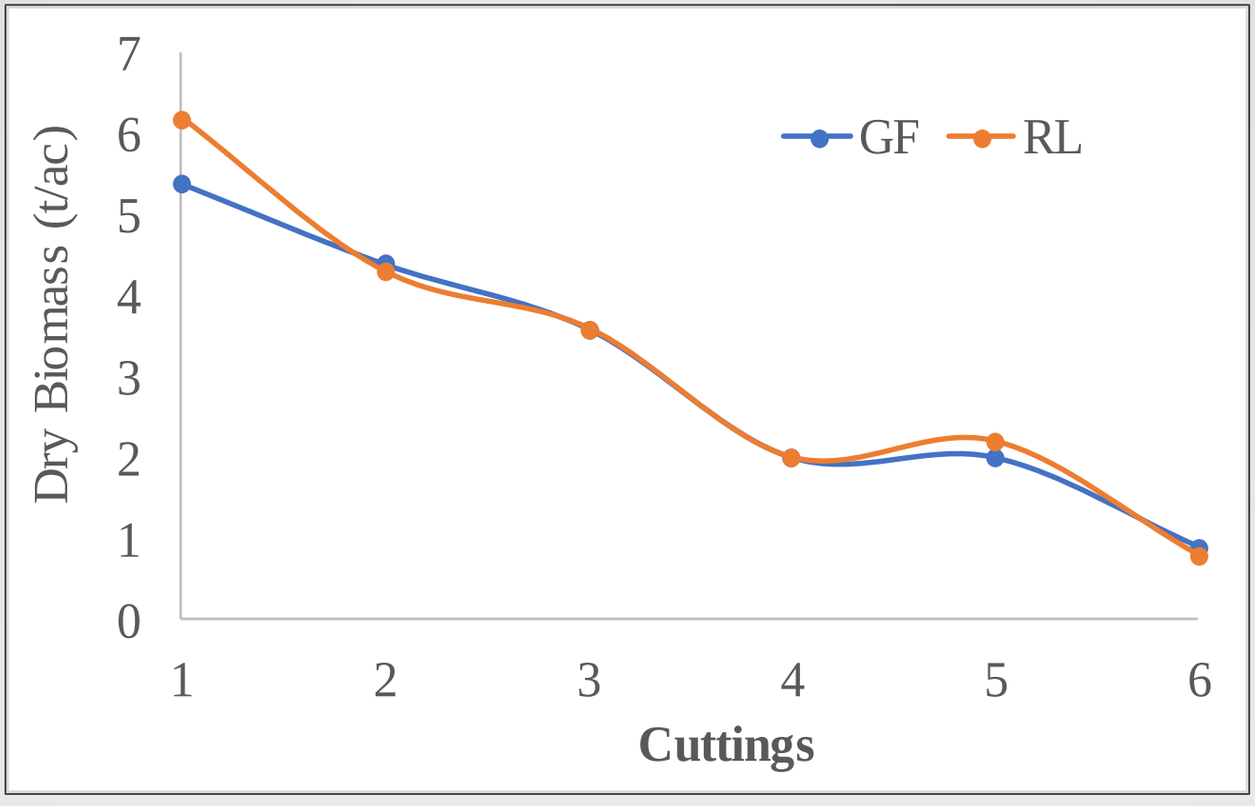
- Quick germination (4-7 days) & full groundcover within 3 months

Biomass Yield

- Harvest @ 5% of crop in the boot stage

First year biomass (t/ac) – 6 cuttings

Variety	*5-May*	*21-Jun*	*28-Jul*	*29-Aug*	*10-Oct*	*12-Dec*	*Total*
GF	5.4a	4.5a	3.6a	2.0a	2.0a	0.9a	18.4
RL	6.2a	4.26a	3.61a	2.0a	2.0a	0.8b	19.1
Pr>F	*0.34*	*0.73*	*0.94*	*0.95*	*0.46*	*0.05*	



Second year biomass (t/ac) – 5 cuttings

Variety	24-May	12-Jul	31-Aug	1-Nov	12-Dec	Total
GF	3.4a	3.7a	0.9b	2.3a	1.0a	11.2
RL	2.2a	3.9a	1.9a	2.4a	1.0a	11.4
Pr>F	*0.43*	*0.66*	*0.01*	*0.94*	*0.96*	

Graphical representation (dry biomass production)

Forage Crop hay yield comparison

Crop	Acreage (2016)	2016 yield (t/ac)
Alfalfa hay	154,861	7.19
Bermuda grass hay	50,704	7.89
Klein grass hay	14,590	10.0
Sudan grass hay	43,267	5.66
Rhodes grass	-	**11-19**

Source: 2016 IV Ag Crops & LS Report

Nutritional values from three samplings

Variety	CP%	AFD	dNDF	Ash	dNDF48	dNDF30	TDN
			First cutting				
RL	14.1[a]	37.5[a]	65.4[a]	9.9[a]	38.1[a]	23.5[a]	59.8[a]
GF	14.2[a]	37.8[a]	65.0[a]	9.7[a]	37.5[a]	22.4[a]	59.5[a]
Pr>F	*0.94*	*0.62*	*0.74*	*0.63*	*0.57*	*0.24*	*0.64*
			Second cutting				
RL	12.2[a]	39.73[a]	67.2[a]	10.1[a]	40.8[a]	28.7[a]	63.2[a]
GF	12.1[a]	41.2[a]	68.8[a]	10.0[a]	41.6[a]	28.9[a]	61.8[a]
Pr>F	*0.94*	*0.41*	*0.4*	*0.74*	*0.25*	*0.71*	*0.26*
			Third cutting				
RL	12.4[a]	38.9[a]	69.4[a]	10.1[a]	40.0[a]	28.9[a]	59.2[a]
GF	13.4[a]	38.4[a]	67.5[a]	10.1[a]	40.2[a]	29.5[a]	62.1[a]
Pr>F	*0.24*	*0.69*	*0.32*	*0.93*	*0.68*	*0.62*	*0.16*

Means in each column followed by the same letter under each cutting is not significantly different from each other.

Forage nutrient component comparisons

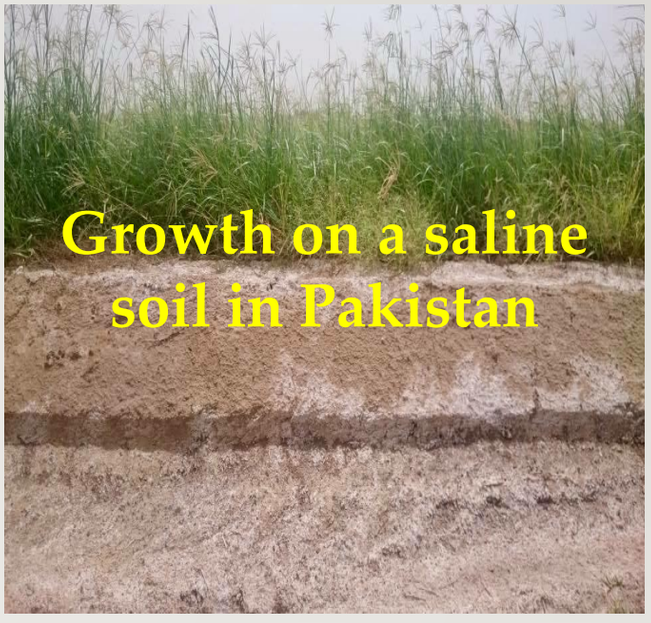
Crop	CP	TDN	ADF	NDF
Alfalfa	17-29	50-56	26-35	40-50
Bermuda grass	8-12	43	32-43	70-78
Sorghum / Sudan grass	8-15	-	29-40	55-65
Corn Silage	6-9	70	28-43	51-68
Wheat straw	4	-	54	85
Rhodes grass	**12-14**	**59-63**	**37-41**	**65-69**

Source: Putnam (ag practices for forage quality)

- One of the largest challenges for grower's is the increased interests on forage quality
- Forage quality affects both market and crop management
- Forage quality is a complex trait in plants & can be affected by genetic, environmental and agronomic factors, but most often defined in terms of dairy production (energy calculated from the fiber)
- Most energy estimated (TDN, NEL) are calculated from a fiber measurement (ADF, NDF). Hence, TDN and NEL are equivalent to ADF / NDF measurements

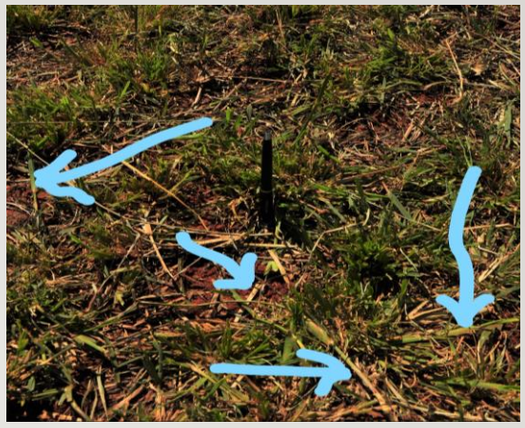
Agronomic Features & Breeding

- Sub-Tropical C_4 Grass
- Widely adaptable from soils of pH 4.5 to 8.5, salt tolerant up to 12 dS/m



Morphology / the stolons

- Spreads through stolons (Stoloniferous) & highly productive



- The culms are tufted or creeping, sometimes rooting from the nodes

Breeding & Optimization

- Selected Seeds, Australia; states "breeding program started 30 yrs ago"
- Previous RG were wild selections & inconsistent in feed bunks (Animals "sorting" leading to wastage)
- Breeding undertaken to optimize it as fine stemmed leafy Rhodes Grass

Two Prominent varieties

1) Reclaimer;

- Diploid Rhodes grass cultivar
- Breed for aggressive stoloniferous growth habits, salt tolerance, fine leaf, fine stem and high dry matter yields
- Exhibits higher cool season tolerance

2) Gulfcut;

- ✓ improved diploid cultivar
- ✓ bred for its extremely fine stem, erect growth habit & high leaf production.
- ✓ well suited for hay production

Planting

- Good when temperatures are 60F & above
- Small seed so planting no greater than 3/8”
- Planting rate about 20lbs per acre

Soil & Fertilizer Requirements

- Nutrient decisions varies upon locations,
- but Split applications of 50-100 kg/ha N, are normall

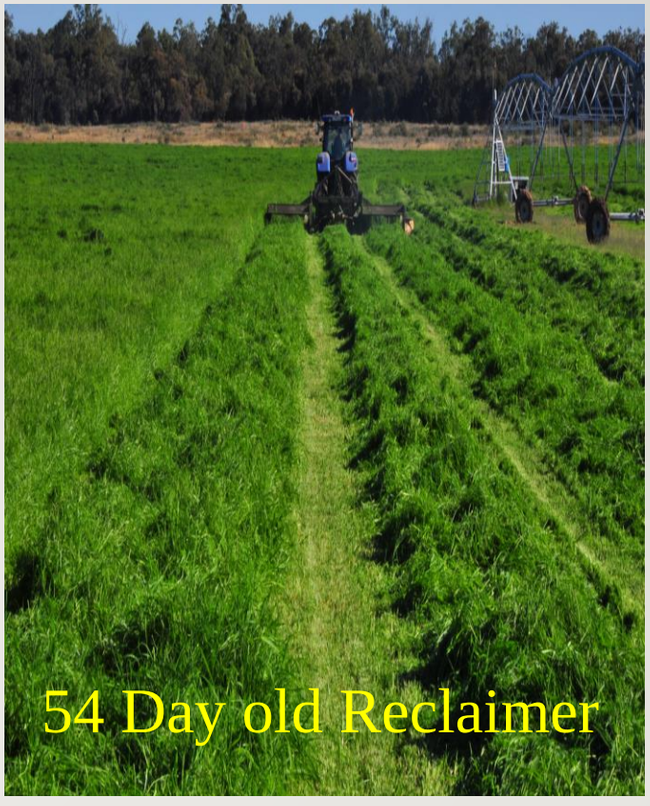
Rhodes grass responds well to N fertilizer

Species	N-fert.	Regrowth days	DM yield kg/ha %	CP %
Rhodes	0	17	1340	13.3
Rhodes	+	17	2200	18.1
Rhodes	0	34	1880	12.3
Rhodes	+	34	3790	15.1

Keftasa, 2006

Harvesting

- 1st cut is @~ 50 days from planting
- Subsequent cuttings could be every 30 days (summer)
- Could have ~ 6 cuts per year
- Dormant during winter Dec-Feb
- Stand persistence is 3+ Years


54 Day old Reclaimer

Other desirable Characteristics

- Tolerates mechanical damages
- Crop after the damage (bottom)

Weed Control

- Not a problem at all
- May need BL weed control at establishment
- Vigorous competitor once established

Pest & disease management

- No specific pests/disease observed
- Needs to monitor for Armyworm (*Mythimna. Unipuncta)* & Grasshoppers

Suitability for Pasture (not tested here)

- Suitable for rainfed & irrigated systems
- Drought resistant & high WUE
- Highly desirable for direct pasturing, palatable
- Suitable for all animals
  (Dairy, Beef, Horses, Goats & Sheep)

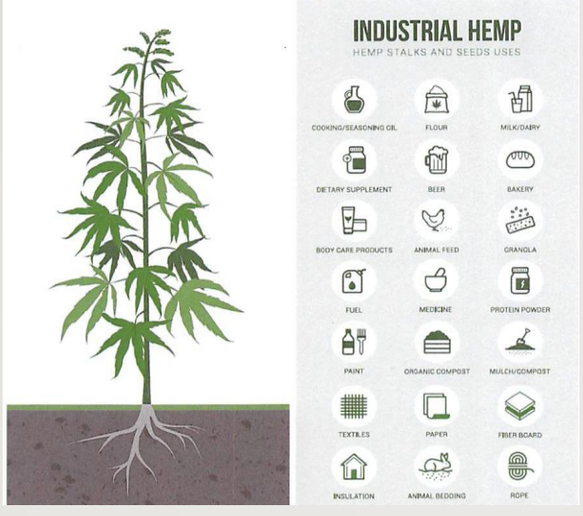
Summary (strengths)

- Easy establishment & outcompete weeds
- High yielding
- Widely adaptation & high WUE
- Excellent nutritive value
- High salt & stress tolerant
- Rare pests or diseases
- Tolerate / suppress nematodes
- Tolerant of heavy grazing

Summary (limitations)

- Not adapted to acid, infertile soils.
- Plants require optimum fertility for full production
- Low shade tolerance.

Industrial Hemp, *Cannabis sativa L; Could it be a* Low Desert Crop?



- ✓ What is industrial hemp?
- ✓ History of the Industrial hemp
- ✓ Regulations & restrictions
- ✓ potential to be alternative crop
- ✓ Planned UCCE research project

Backgrounds

- Industrial hemp (*IH*) - dioecious annual plant
- Versatile crop known to produce;
  - ✓ food, fuel, feed, fiber for textiles, oils for industrial & cosmetic purposes, pharmaceuticals, & over 25,000 products

Suggested Productivity

- Produces 3 times the amount of fiber as cotton from the same size of land

  (Cherrett, et al., 2005)

  - ✓ Consumes 66% to 76% less water than cotton *(Yvonne S- azcentral.com);*

  - ✓ Heat tolerant

Environmental adaptations

- Suggested to prefer a mild climate, but is well adapted / grown in the states of Nevada & Arizona (www.coloradohempproject.com), with very similar weather to the low deserts of Southern CA

- Suggested to have evolved originally as desert plant & referred to as ***xeric plant***,
  - ✓ Plants that develop survival mechanisms for low rainfall &
  - ✓ Adaptation mechanisms to arid climate – produces ***trichomes*** – structures that reduce loss of water from leaves

- Develops deep tap roots, hence can find water sequestered in the ground *(Amaducci, et al. 2008)*
- Preferences are alkaline soils of pH 7 to 7.5.
- Grows faster, produces high yields & can be grown without heavy use of pesticides.

So, it is misunderstood for its "preferred" growing environment reference to a "crop of mild climate"

- Rather, its growth characteristics & resource conservation mechanisms point out that it has great adaptability to the low desert

History of IH in the IV

- Per IVP sou
  dates back t
- IH farming
  federal law
  sudden peop

Imperial County Hemp, 1920

"Hemp at Timpken Ranch

https://www.thecannachronicles.com/imperial-county-hemp-1920/

Current growth – IV
Conservation Research Center

Potential pathogens (see chlorosis)

https://www.thedesertreview.com

Potential Low Desert Productivity

- The Low Desert being unique in its weather, *IH* can grow throughout the year for multiple harvests, at least 2 harvests / yr.

- Could be a substantial revenue & economic potential for growers of Imperial County, the state & the country, in general

Restrictions / Regulations

- Not been grown legally in CA for many years, due to regulatory restrictions.
- In recent years, restriction became loose & many industry groups have shown research interest

The Ease in regulations

- The 2015 federal law removed hemp from the list of controlled substances as long as its tetrahydrocannabinol (THC) content do not exceed 0.3%.

- Senate bill #566 (the CA *IH* Farming Act), defines *IH* as a fiber or oilseed crop

CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

CalCannabis
Cultivation Licensing

1220 N Street, Sacramento, CA 95814 • 1-833-CALGROW (1-833-225-4769) • calcannabis@cdfa.ca.gov

Apply Now: Applications for Temporary and Annual Cannabis Cultivation Licenses

The California Department of Food and Agriculture's CalCannabis program is now accepting **applications for temporary and annual cannabis cultivation licenses**.

Agricultural Commissioner
Sealer of Weights & Measures
COUNTY OF IMPERIAL

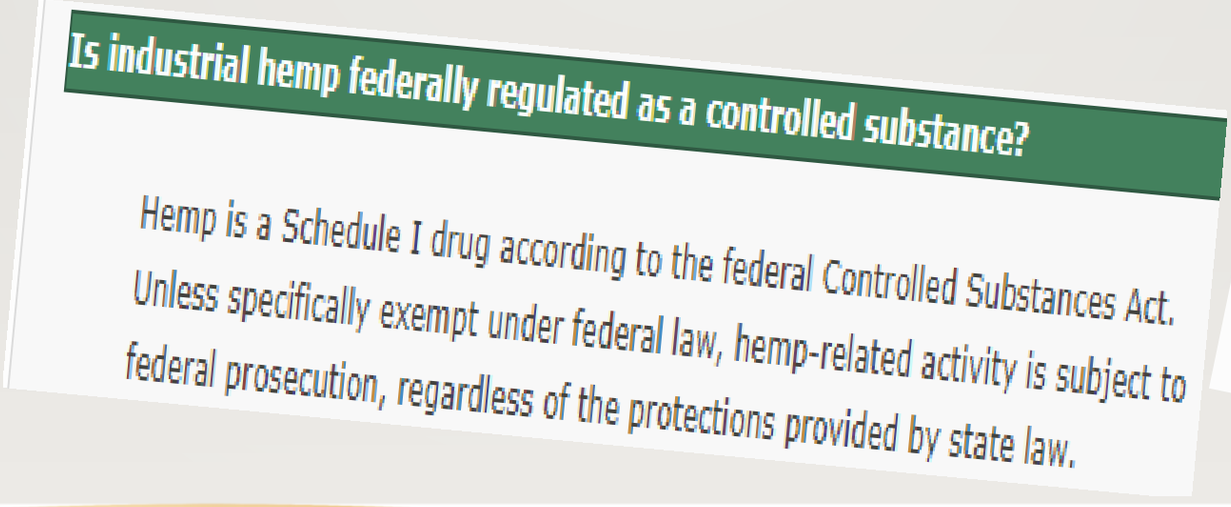
Cannabis Cultivation Licensing & Industrial Hemp Grower Registration

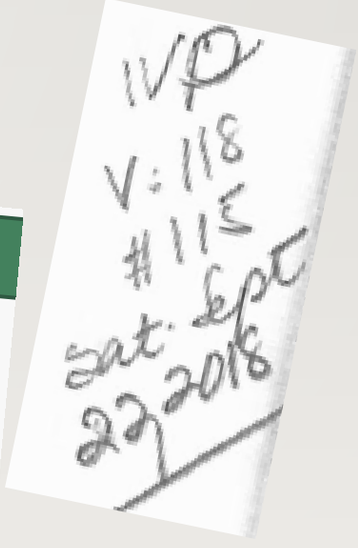
Can I grow industrial hemp in California?

- All commercial growers of industrial hemp must register with the county agricultural commissioner prior to cultivation.

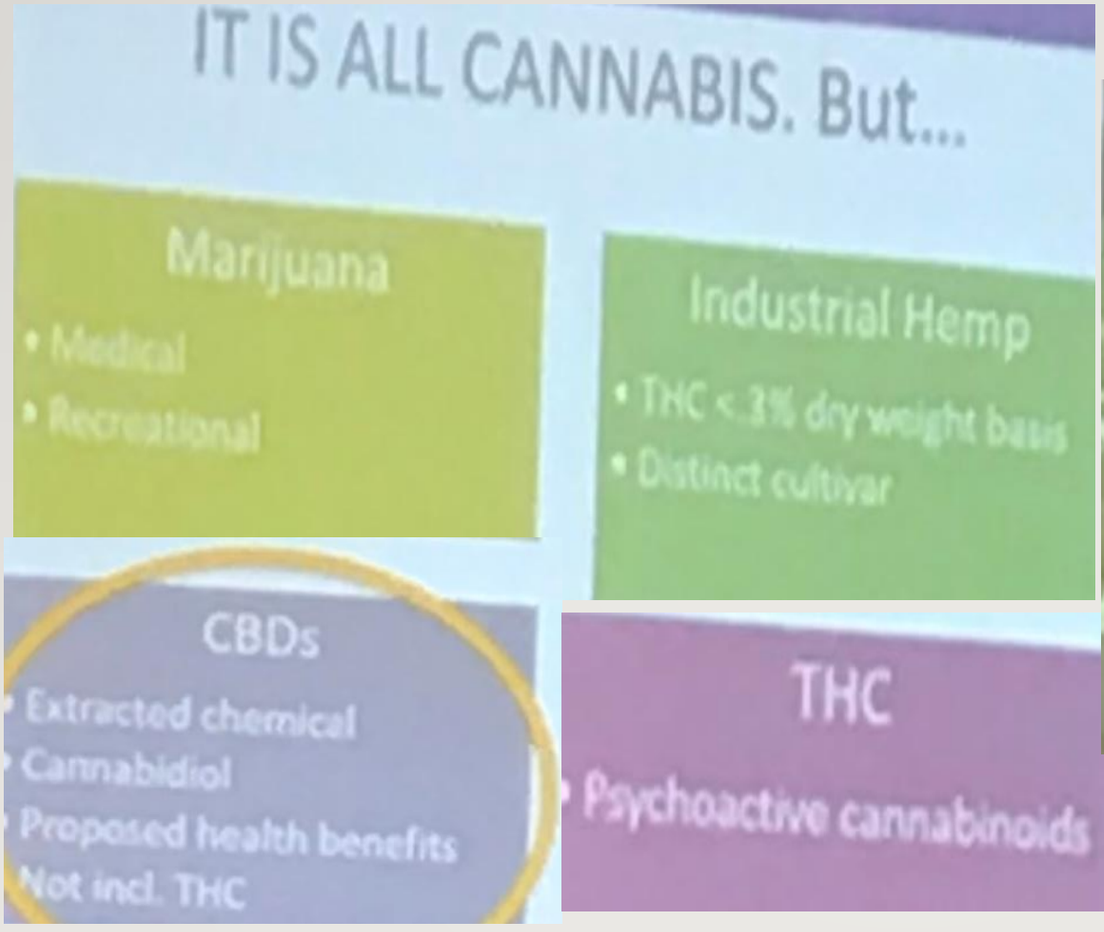
Controversies b/n federal & state laws

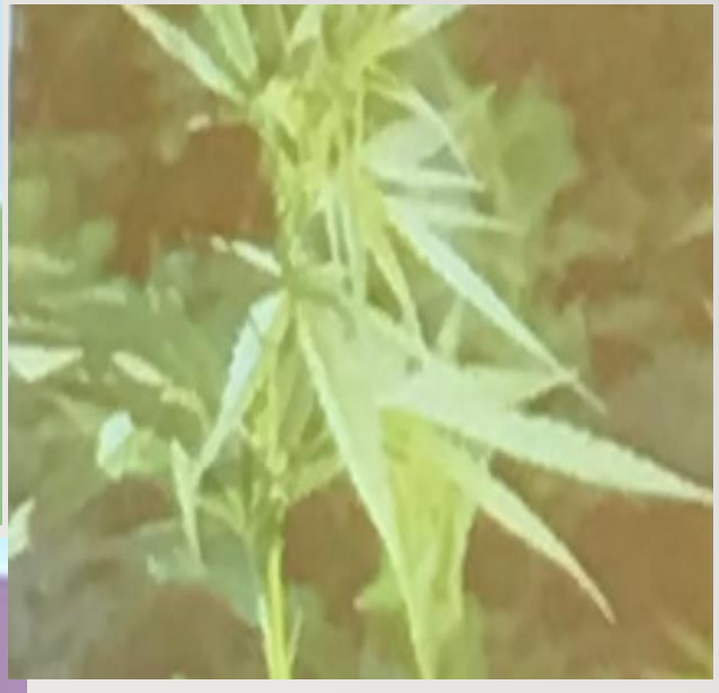
- Although CA allowed permits for cultivating *IH* as long as THC < 0.3%, both **cannabis and IH are schedule 1 substances**, meaning they are prohibited from being cultivated





Some terminologies





Some Shortcomings

- Currently available cultivars are developed for cooler environments

  - ✓ May be sensitive to high & low temperatures *(Amaducci, et al. 2008)*

  - ✓ Hence, the need for testing available cultivars if they withstand heat, high temperatures & other environmental conditions of the low desert.

Planned Research Projects

- Recognizing the desirable benefits of this crop, the potential adaptability & future economic benefits,

- ✓ UCCE Imperial County intends to conduct research at the UC Desert Research & Extension Center

Our Objectives

- Test adaptability to withstand the dry & hot weather conditions of the low desert
  - ✓ determine inputs (fertilizer, water)
  - ✓ evaluate potential seed & fiber yield
  - ✓ repeated trials will identify the best planting & growing seasons

- Produce crop production guidelines

- Periodically test crop THC levels per bill 566 (no more than 0.3% concentration)
  - ✓ Evaluate if heat has effect on [THC]
  - ✓ If levels exceed, trials should be destroyed

Outcome of our Planned Research Project

- Help identify cultivars that may withstand heat, high temperatures & other environmental conditions of the low desert.

- Evaluate *IH* susceptibility to low desert pests

- Help develop systems & protocols for development & implementation of *IH* production guidelines for the low desert

*** More information after the experimentation*

Acknowledgments

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Thank you