Key Agronomic Strategies for Integrated Alfalfa Pest Management (IPM) "Integrated Crop Management"

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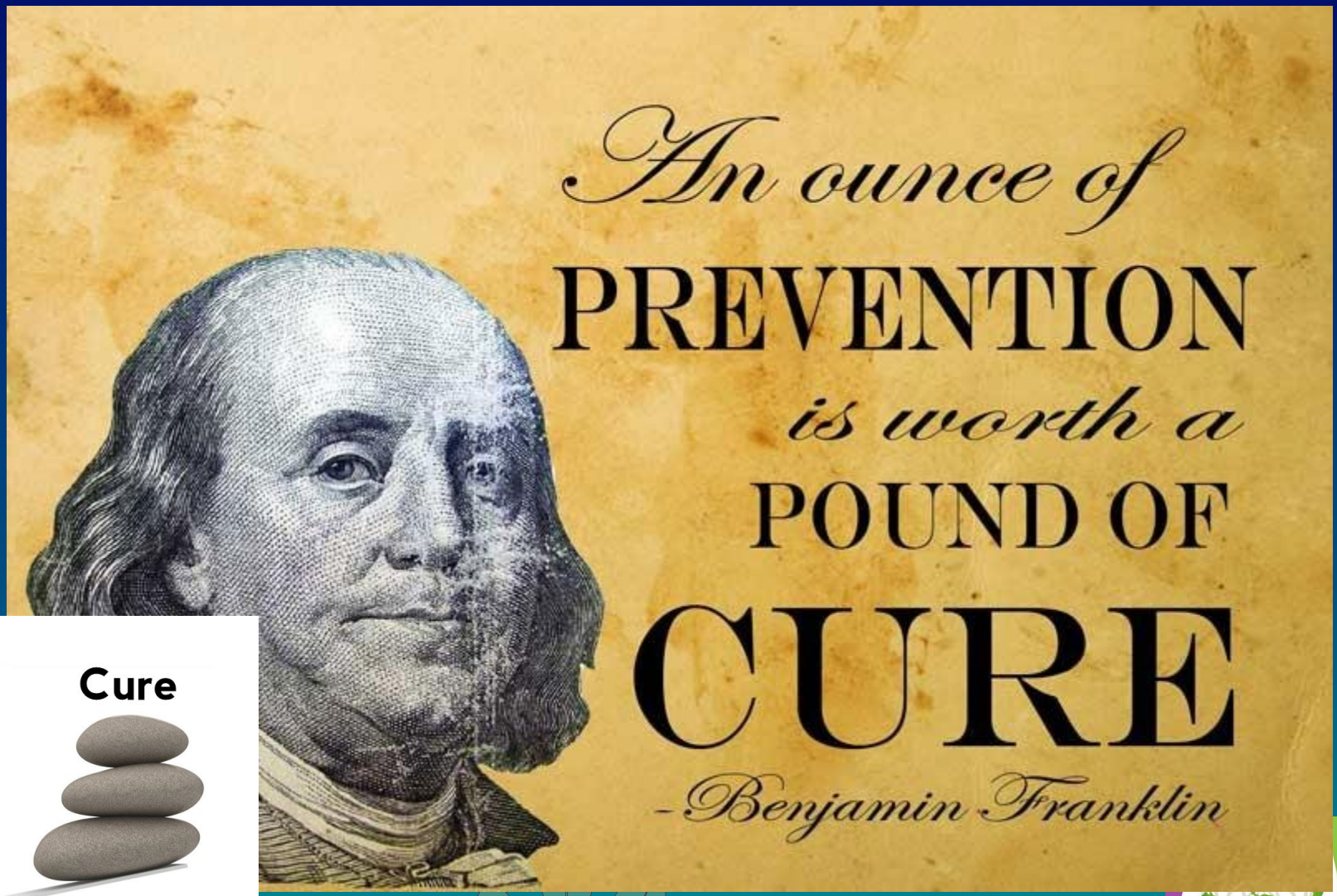
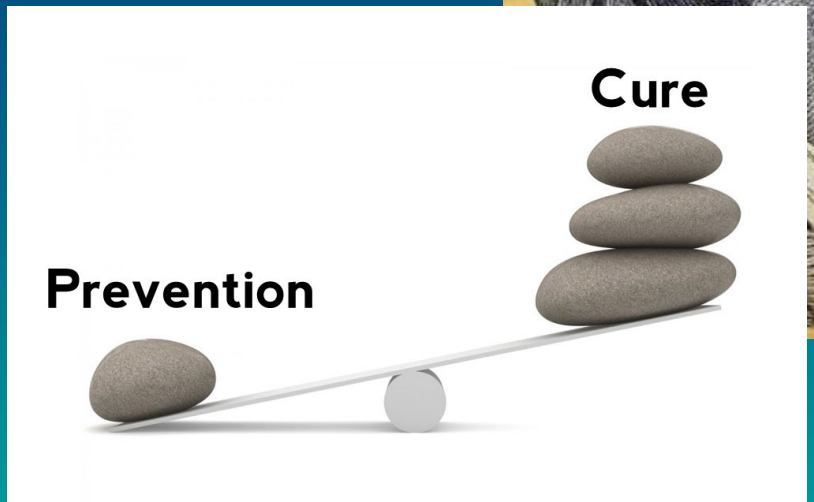
Integrated Crop Management:





Integrated Pest Management (IPM): it's not just insects

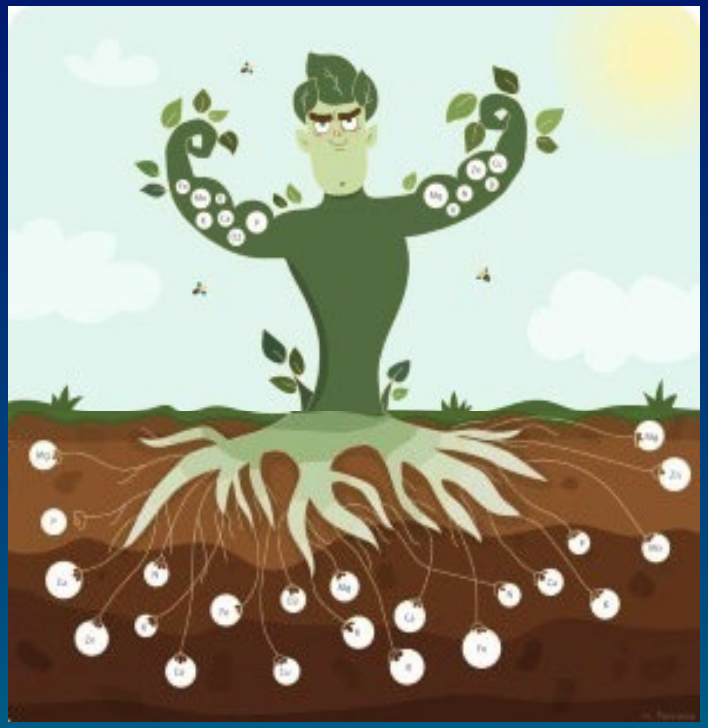
Hierarchy of Pest Concerns in Alfalfa:

- Weeds
- Insects
- Gophers/rodents
- Nematodes
- Diseases

(importance differs by region and farm)

Optimizing the Plant and Environment to Prevent Pests

Plant Defense
(Genetic Resistance)



Plant Nutrients
(Soil Fertility)

Soil Health
(Biological and Physical)

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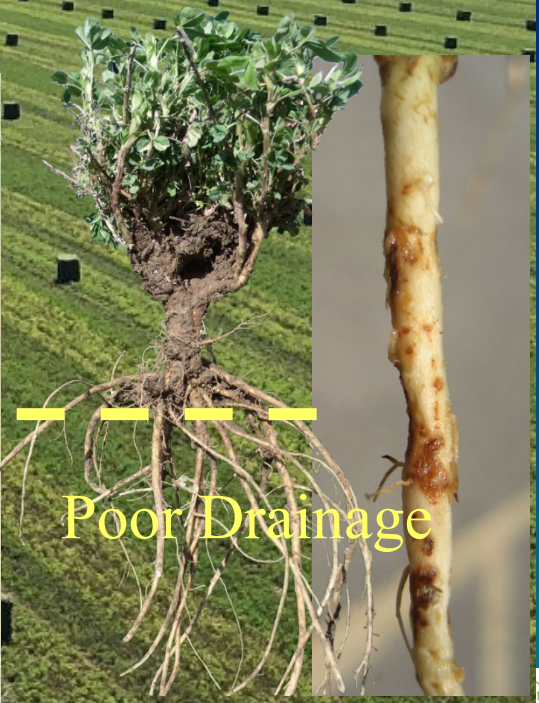
Integrated Crop Management Impacts IPM



Poor Drainage

Phytophthora

A deep truth…..

- **A vigorous deep-rooted alfalfa crop is the best defense against weeds, diseases and insects**

Key Practices that impact IPM

- I. Soil Prep & Fertility Management
  - What is limiting regrowth?
- II. Stand Establishment Technique
  - Soil Prep, Timing, Technique
- III. Variety Selection
  - High yield, Multiple Pest Resistance
- IV. Irrigation Management
  - Prevent standing water, excess moisture
- V. Harvest Management
  - Delayed Harvests strengthens roots/regrowth
- VI. Cropping Systems/Rotation
  - Key for preventing weed/disease buildup

Early Steps: Stand Establishment

- Good Stand Establishment method: likely THE most important IPM practice!

1. Planted on time
2. Beds allow drainage
3. Seeding depth
4. Weed control
5. Careful irrigation

I. Soil Prep, Soil Health, Fertility:

Analysis of Major Soil Issues for short & long term

- Soil Prep & Fertility: DRAINAGE is key
- Liming/amendment needs?
- Need for deep tillage? for long-term
- Levelling? Standing water causes stand loss and root diseases.
- Long term fertility program (P,K,S)? Micronutrients (Mn, B)? Have you tested?
- Is your soil healthy, without major limitations?

Soil Impediments… Can limit growth for years

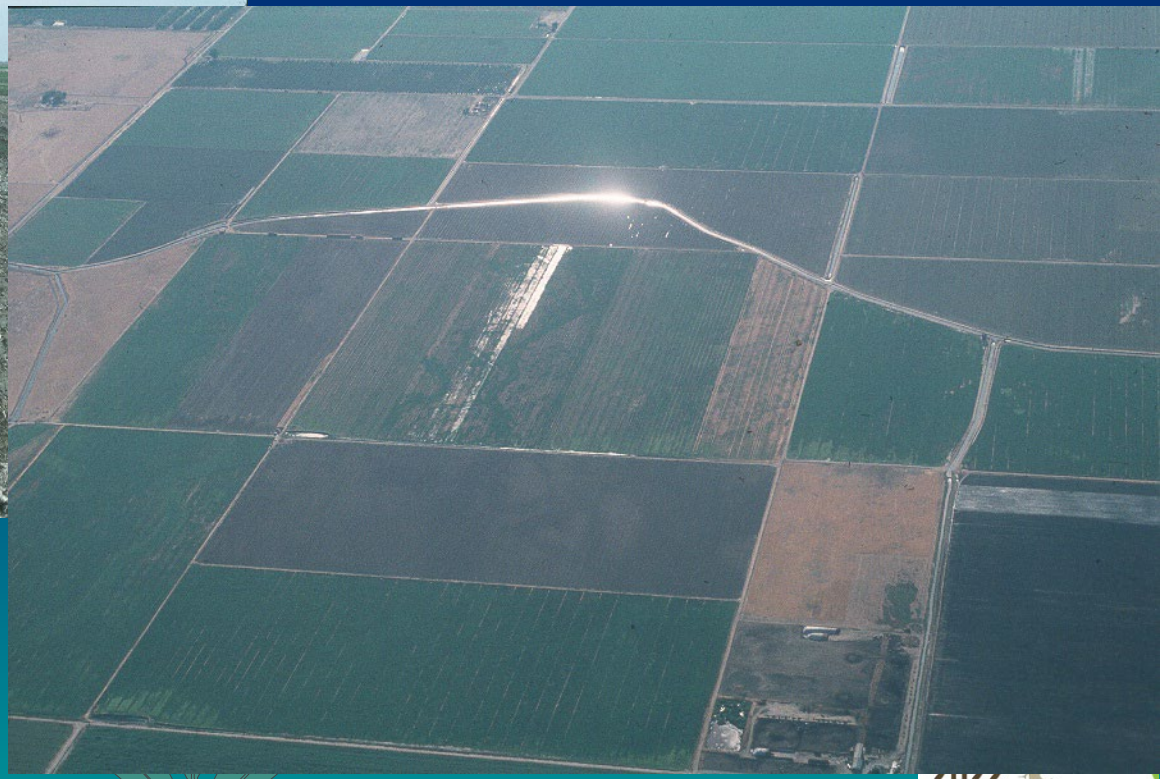
Even on sands – layers occur

Ripping to moderate depths 0.5 to 0.75 meters almost always recommended

Soil Condition & Prep impacts pests:

- Drainage impacts soil diseases
- Deep Tillage disrupts gophers/rodents
- Oxygen, infiltration-improves root depth & health
- Land Levelling and Final tillage impacts:
  - Germination, seedling health
  - Standing water – seedling diseases

Leveling—Critical for Flood Irrigation



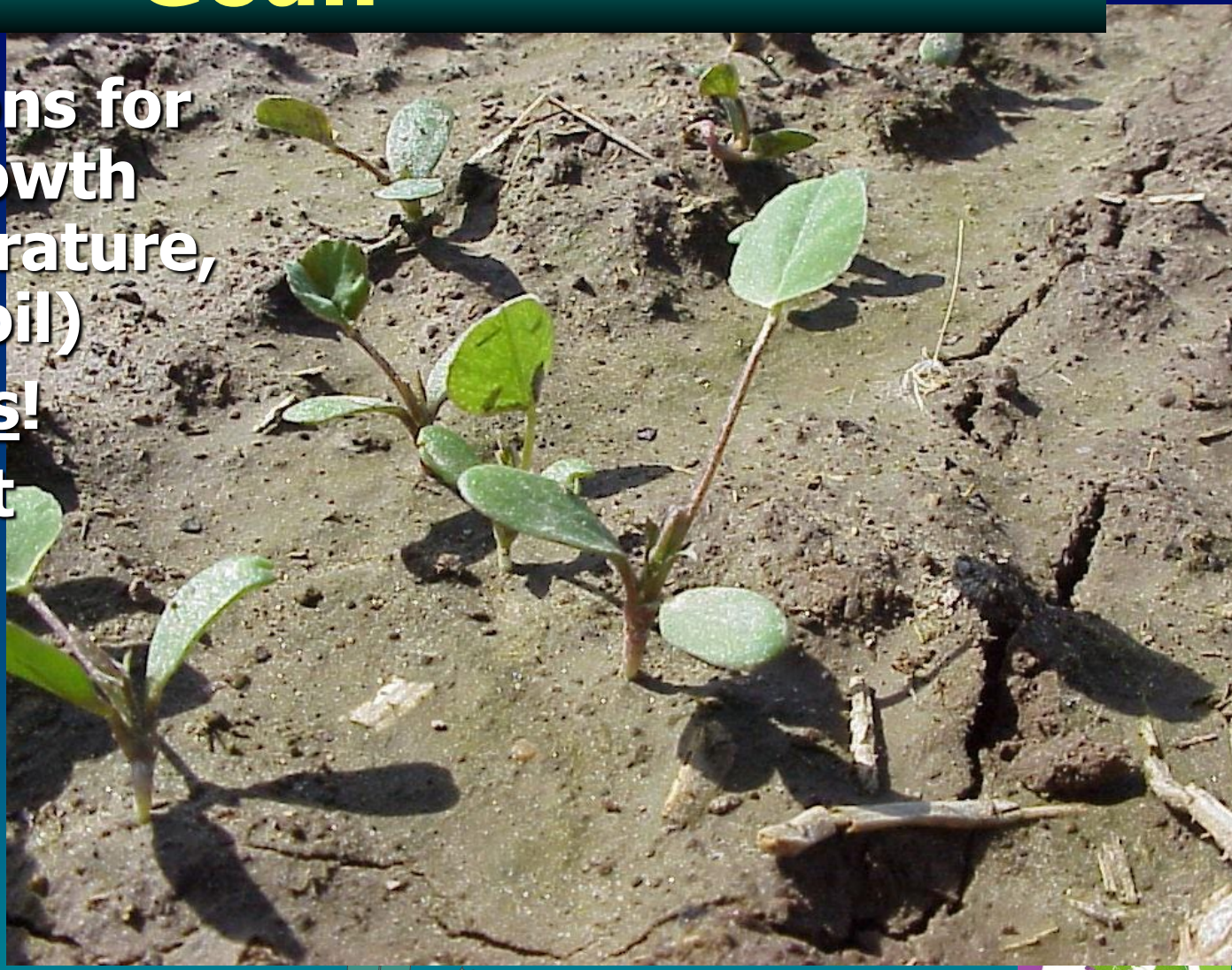
Small Problems last for years…

II. Stand Establishment: Skill and Technique

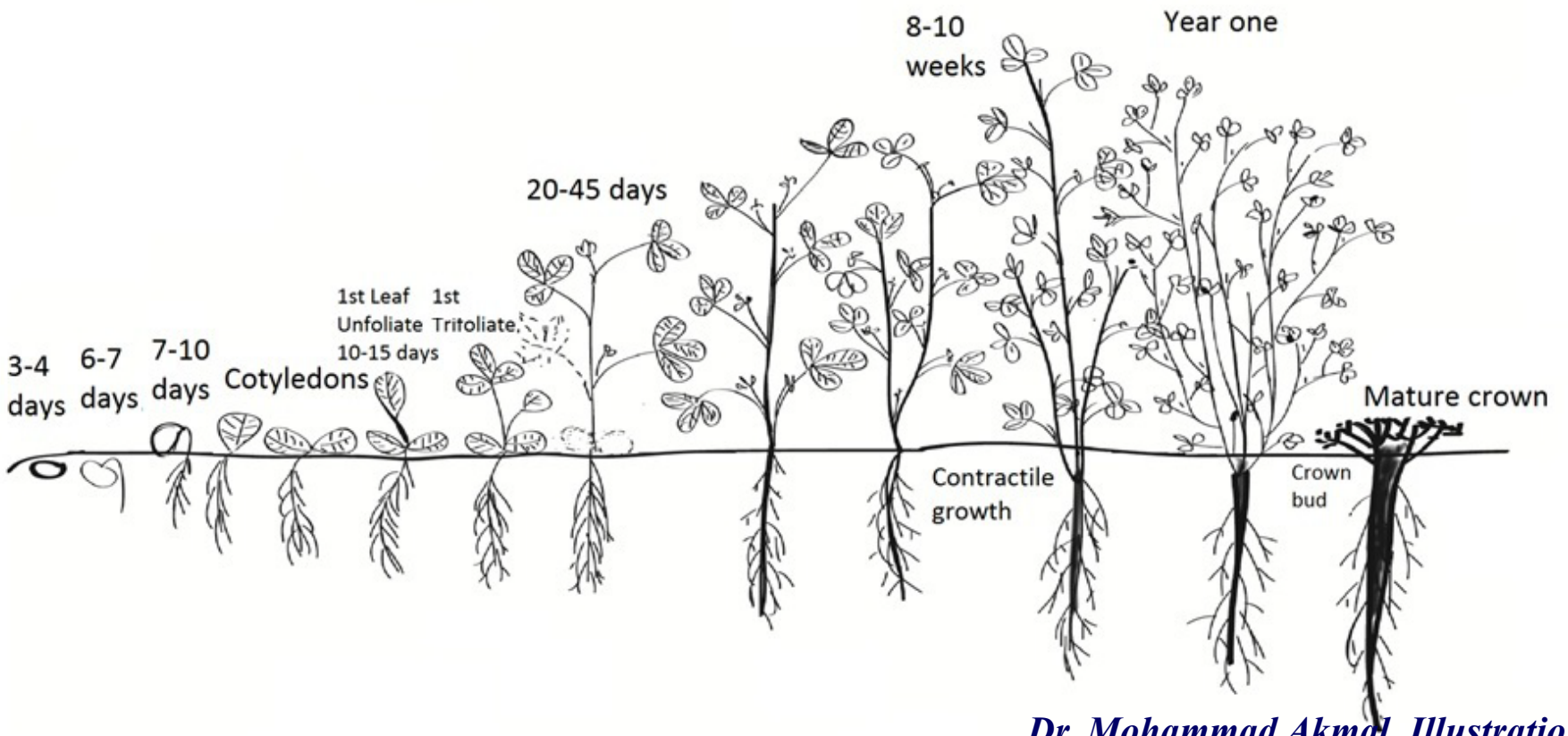
- Timing – plant early fall when optimum for seedling development (late summer, intermountain)
- Seeding Depth, good soil-seed contact
- Distribution of seed (broadcast? Drill?)
- Early irrigation management
- Control of early weeds (key problem for organic)

Goal:

- Optimize conditions for early seedling growth (moisture, temperature, solar radiation, soil)
- Farm for the roots!
- Wait, wait on first harvest!

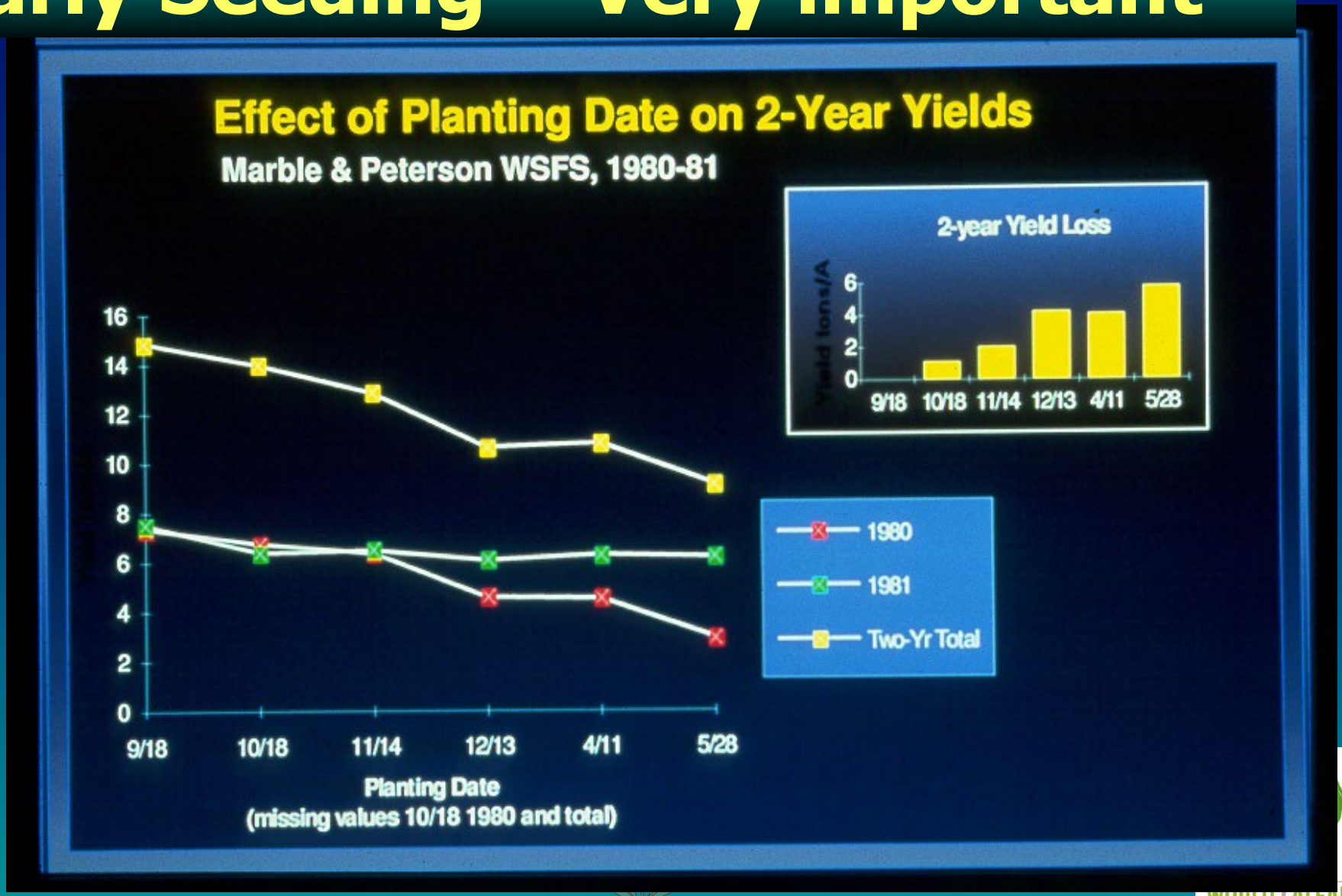


Alfalfa must be nurtured from a 'baby' to strong, deep-rooted plant

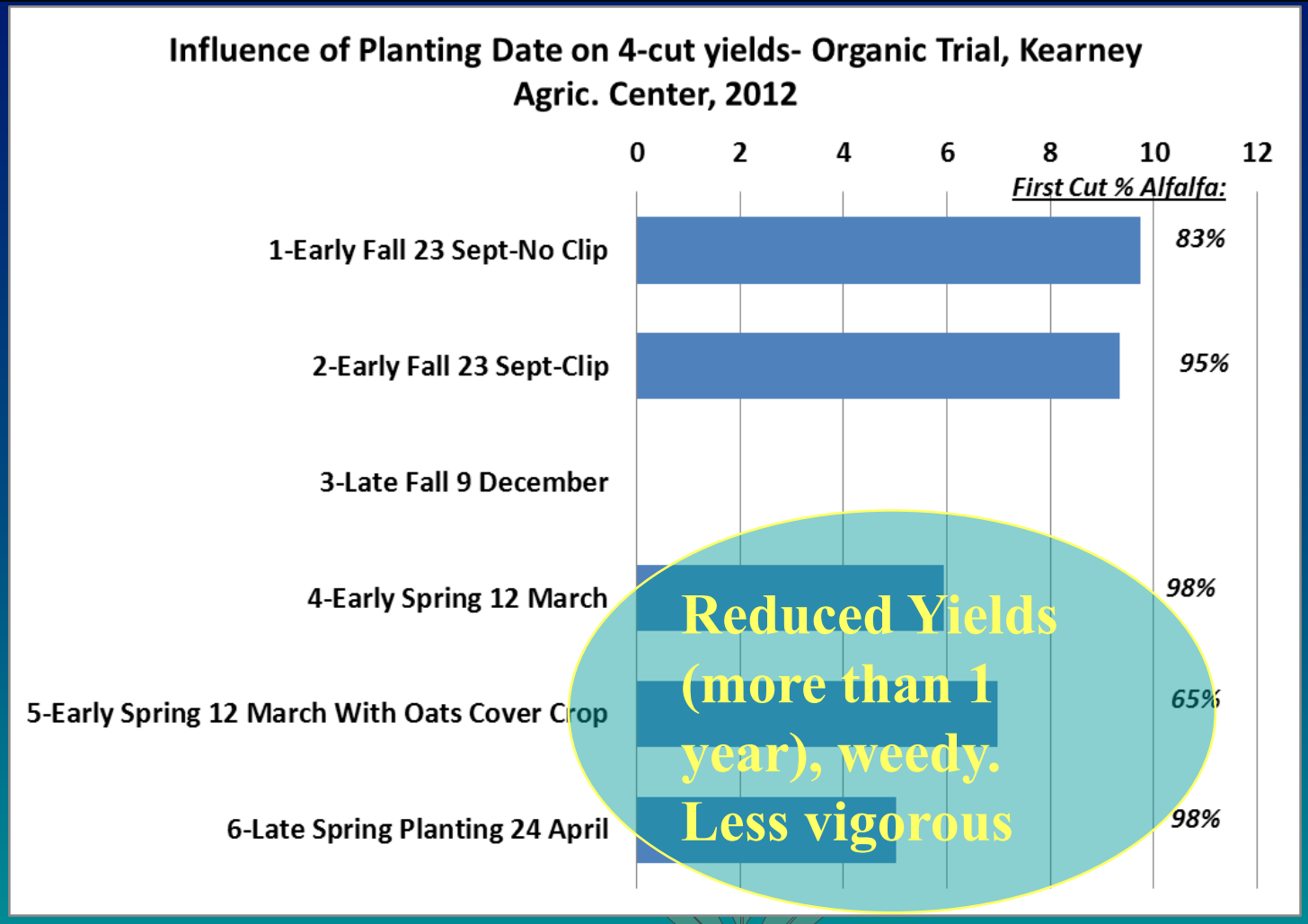


Dr. Mohammad Akmal, Illustration

Early Seeding – Very important

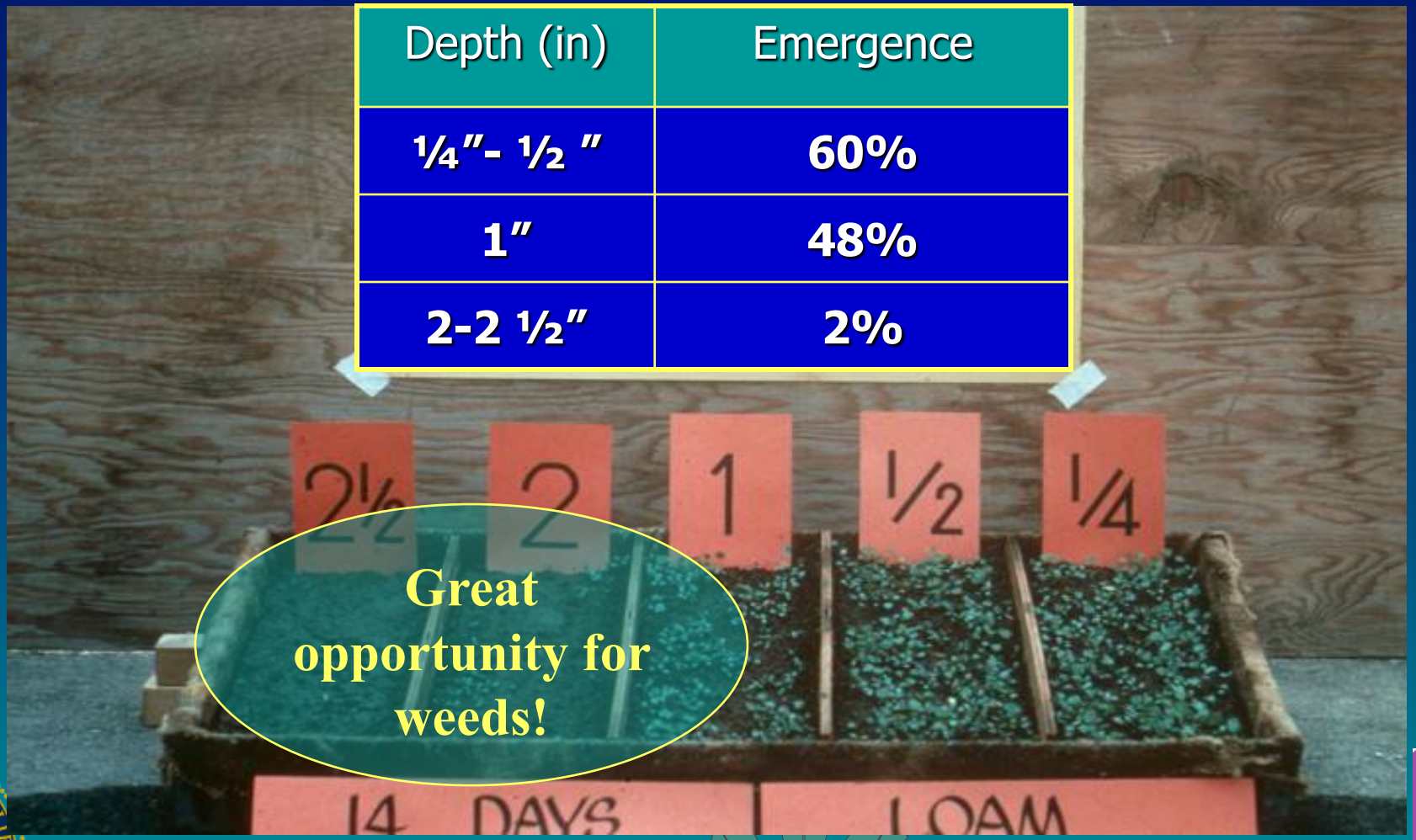


Influence of Planting Date on Year 1 yields (Fresno County), 2012



Planting Depth is Critical

Depth (in)	Emergence
¼"- ½ "	60%
1"	48%
2-2 ½"	2%



Great opportunity for weeds!

Prevent Standing Water during establishment

- Poorly drained Fields
- Moves water down fields – prevents standing water
- Prevents seedling diseases/stand loss

Early Control of Weeds is important

Little problems become….

Big Problems

II. Soil Fertility Management

- Test Soils for limiting nutrients
  - Key are P, K, S, sometimes micros
- Examine annual uptake levels
  - Apply for long-term
- Soil Ph, salinity need for Gypsum?
- Vigorous top growth, vigorous roots
  - Resists diseases, weeds, nematodes

III. Variety Choice: A Key IPM Strategy

- **Select for yield, yes, since high yielding crops are more competitive with weeds**
- **But….. There is more**

Alfalfa Variety Ratings 2022

Winter Survival, Fall Dormancy & Pest Resistance Ratings for Alfalfa Varieties

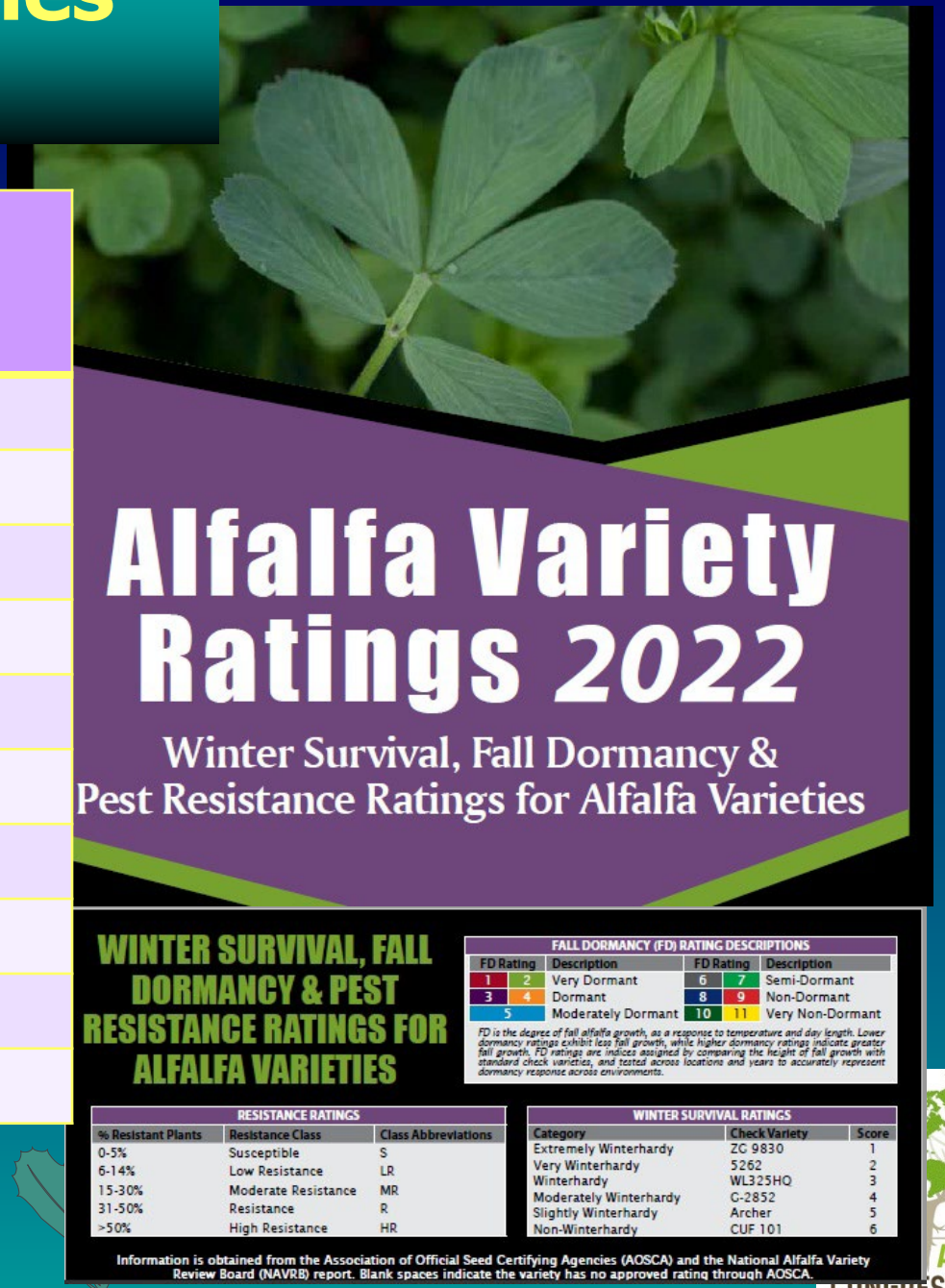
Alfalfa has a wider range of Pest resistances than most crops

www.alfalfa.org

Characteristics:	Range
Fall Dormancy (FD)	2-10
Winter Survival	1 (superior)-6 (none)
Bacterial Wilt (BW)	S to HR
Verticillium Wilt (VW)	S to HR
Fusarium Wilt (FW)	S to HR
Anthracnose Race 1 (Anth1)	S to HR
Phytophthora Root Rot (PRR)	S to HR
Spotted Alfalfa Aphid (SAA)	S to HR
Pea Aphid (PA)	S to HR
Blue Alfalfa Aphid (BAA)	S to HR
Stem Nematode (StN)	S to HR
Aphanomyces Race 1 (ANT1)	S to HR
Aphanomyces Race 2 (ANT2)	S to HR
S. Rook Knot Nematode (SRN)	S to HR
N. Root Knot Nematode (NRN)	LR to HR
Potato Leafhopper (PL)	S to HR
Mulifoliolate Expression (MF)	L to H
Continuous Grazing Tolerance (GT)	Y or N
Standability Expression (St)	MR to R
Salt Tolerance (G-Germination, F-Forage)	G or F
Technology (H-Hybrid, R-RRA)	C or H or RR

Check Out the Varieties
www.nafa.org

Fall Dormancy Rating	Number of varieties	Fall Dormancy Class
2	2	V. Dormant
3	12	Dormant
4	82	Dormant
5	30	M. dormant
6	14	Semi-dormant
7	9	Semi-dormant
8	9	Non-dormant
9	16	Non-dormant
10	2	V. Non-dormant
Total	176	



Web Delivery (https://alfalfa.ucdavis.edu)

University of California Alfalfa & Forages

Home | Producing Alfalfa | Variety Selection | Symposium | People | Fact Sheets

Variety Selection

Click on a city below to view variety trial data:

Agronomy Progress Reports:

These publications detail alfalfa yield trial data for single harvest, single year, and multi-year summaries for each year. Usually, both conventional and Roundup-Ready (RR) lines are tested. Yield trials are conducted in five regions in California: the Intermountain area, the

UC Davis Variety Trials

UC Davis Cultivar Alfalfa Variety (planted 2019)

Current Summary:

2019 - 2021 UC Davis Cultivar multi-year summary

Multi-year and Single-year Data:

2021 UC Davis Cultivar single-year data

2020 UC Davis Cultivar single-year data

UC Davis Cultivar Alfalfa Variety (planted 2014)

Final Summary:

2014 - 2017 UC Davis Cultivar multi-year summary

Multi-year and Single-year Data:

2017 UC Davis Cultivar single-year data

2016 UC Davis Cultivar single-year data

2015 UC Davis Cultivar single-year data

UC Davis Cultivar Alfalfa Variety (planted 2011)

Final Summary:

2011 - 2014 UC Davis Cultivar multi-year summary

Multi-year and Single-year Data:

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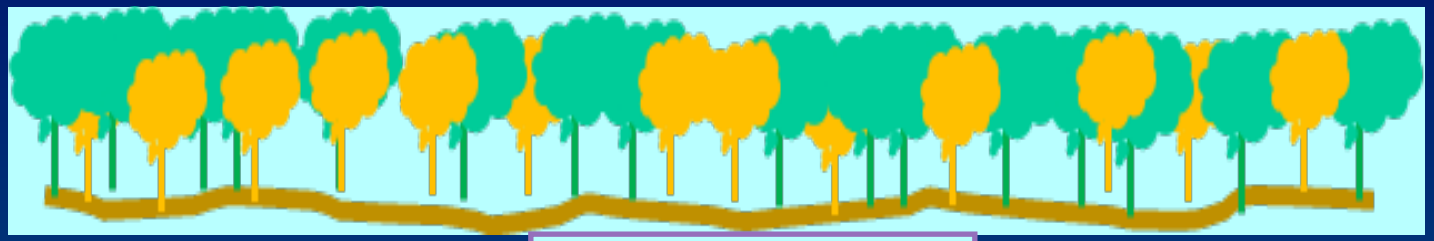
Pest Resistance in Alfalfa:

HR	(Highly Resistant)	>51%
R	(Resistant)	31-50%
MR	(Moderately Resistant)	15-30%
LR	(Low Resistance)	6-14%
S	(Susceptible	<5%

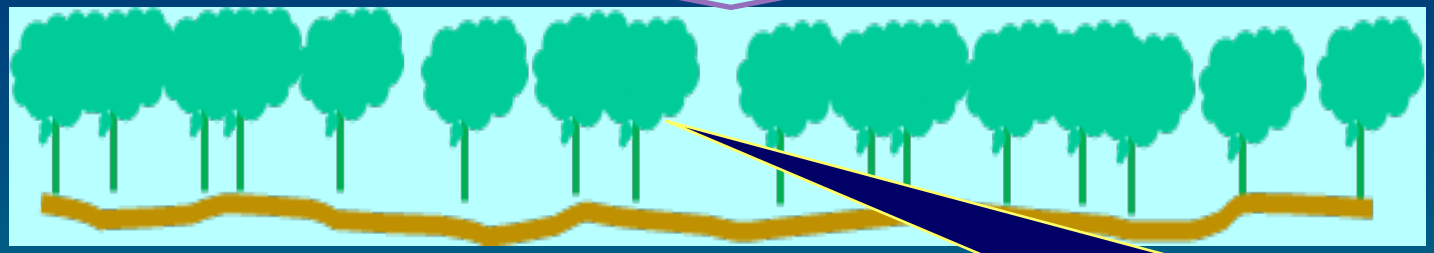
**Resistance is always a quantitative trait (% of a population)*

Alfalfa Disease or Insect Resistance:



Seedling Stand (80 plants/ft^2)
51% Resistant (HR)

Disease Screen



Established Stand (40 plants/ft^2) Highly Resistant

Still plenty of plants to achieve high yields and resist pests

Recommended Resistance levels:

Table 1. Recommended Fall Dormancy range and pest resistance ratings for different regions of California. Alfalfa has a greater range of genetic pest resistance characteristics than many crops.

Zone	FD	SAA	PA	BAA	PRR	BW	FW	VW	ANT	STN	RKN
Intermountain	2-4	S	R	R	R	R	HR	HR	HR	HR	R
Sacramento	4-8	MR	HR	HR	HR	MR	HR	R	R	HR	R
San Joaquin	7-9	R	HR	HR	HR	MR	HR	R	R	HR	R
Coastal	5-7	MR	HR	HR	HR	MR	HR	R	HR	HR	R
High Desert	4-8	R	R	HR	R	MR	HR	HR	HR	HR	HR
Low Desert	8-11	HR	HR	HR	HR	S	HR	S	R	R	HR

FD=Fall Dormancy; SAA=Spotted Alfalfa Aphid; PA=Pea Aphid; BAA=Blue Alfalfa Aphid; PRR=Phytophthora Root Rot; BW=Bacterial Wilt; FW=Fusarium Wilt; VW=Verticillium Wilt; ANT=Anthracnose Race 1; STN=Stem Nematode; RKN= Southern Root Knot Nematode.

Pest Resistance:

Nematode damage

Spotted Alfalfa Aphid

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Is resistance Absolute?

- It's a numbers game……

Alfalfa stem nematode damage

Variety Resistance

- It's often the ONLY cost-effective tool to combat many diseases, nematodes and insects
- Look at Seed Quality (certification)

Seed Quality: Inoculated, certified seed

- Certified, high quality Seed (no dodder!)
- Insect, disease, nematode resistance
- Inoculated

IV. Irrigation Management

- Standing Water = enemy of alfalfa
- Flood irrigation
  - Scald – death of seedling
  - Can damage stands with poor drainage
  - Helps to control gophers!
- Drip irrigation
  - Reduces weed germination (benefit)
  - Bad for rodents/gophers
- Sprinkler Irrigation
  - Also bad for gopher management
  - Leaf Diseases
  - Depth of irrigation? (encourage deep roots?)

Tail-end Damage = Weed Intrusion

Poor Irrigation Uniformity…

Results in Weed Intrusion:

Irrigation effects on rodents

- Key problem is with sprinklers and buried drip
  Keep flooding in the equation (if possible)

V. Harvest Schedule

- First cutting after establishment – delay as long as possible
- Cutting early to mitigate insect populations and clipping for weeds
- 'Staggered' Cutting Schedule: Long cutting schedules with excellent irrigation can improve stand life and reduce weed intrusion

Harvest Management Impacts Weeds:

Maturity	Days	Weeds	Stand
Pre-Bud	21	48	29
Mid-Bud	25	54	38
10%Bloom	29	8	45
50%Bloom	33	0	56
100%Bloom	37	0	50

Data: V. Marble, 1974

Recommend: Allow 'long' schedules at least 2x during year to improve roots and stand longevity, reduce weeds

Cutting Early to Mitigate Pest Damage

Yield and quality losses to summer hay (July, Aug cuttings)

But watch for windrow damage

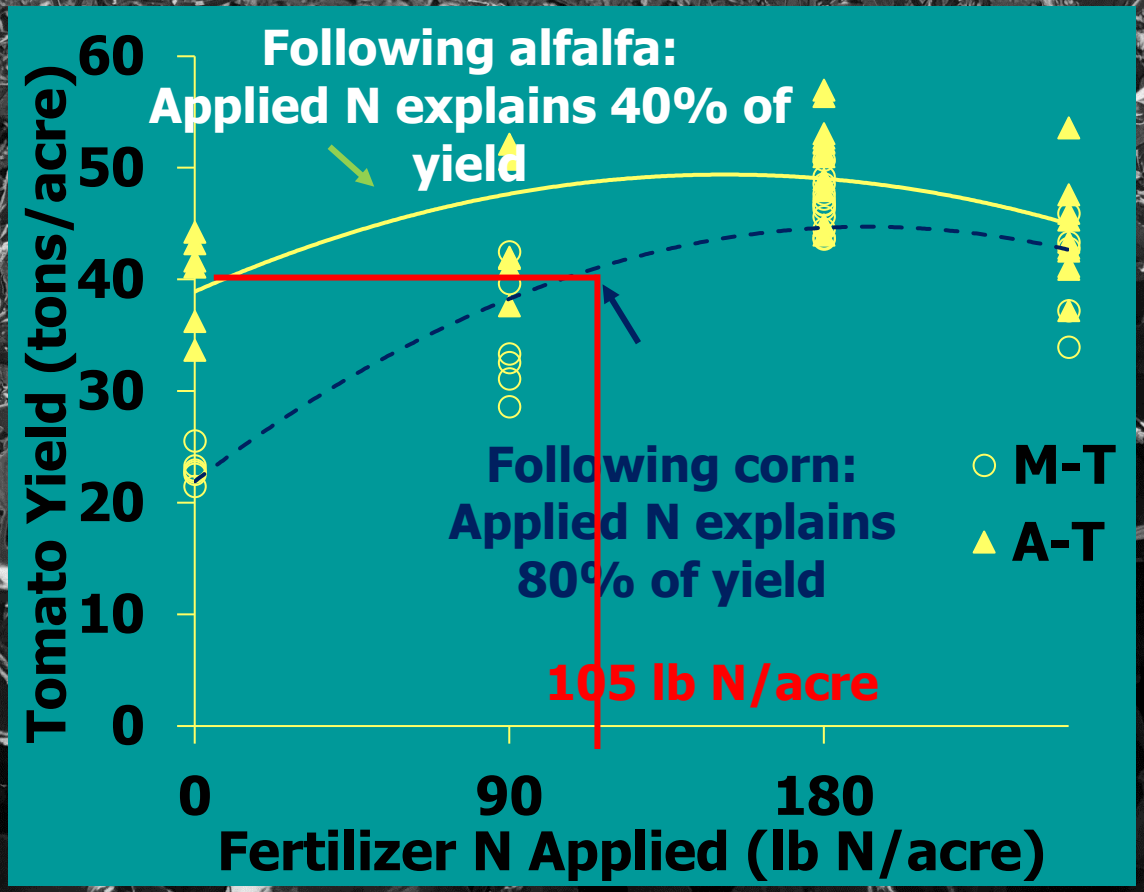
VI. Cropping Systems

- Crop Rotation
- No till
- Grazing
- Nurse crops
- Overseeding
- Traffic
- Equipment Sanitation

Crop Rotation

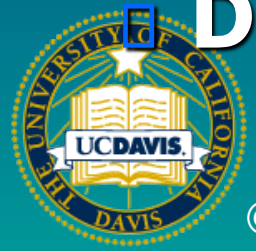
- Highly Recommended
- Rotate with non-susceptible crops
  - Nematodes, diseases
- Weeds are adapted to annual vs. perennial systems
- Diseases build up over time – rotate with grains
- Opportunity for tillage, soil improvement

Residual Nitrogen – Following Corn vs. Alfalfa



Going into alfalfa (rotation):

- Grains/Non-legumes preferred before alfalfa (wheat, corn)
- Annuals (weed populations)
- Back-to-back alfalfa? (not recommended)
  - But has been done – make sure you allow at least short break
- Autotoxicity (suppression of seedling growth following alfalfa)
- Disease/nematode residues



No-Till Establishment

- Suited for pivots, rotations with grains
- Fit with check-flood?
  - Fixing leveling and infiltration problems?
- Prevents weed seeds coming to surface
- Creates other challenges for weeds, root oxygen (soil specific)
- Are soils adequately prepared?
- Soil aeration?

Companion Crops

- Especially for erodible land
- Oats/small grains/peas/berseem
- Low density
- Can contribute to a first cut yield
- Watch it! Aren't you really just planting a weed?? (oats can kill seedling alfalfa)
- Can lower vigor and density of alfalfa

Wheat nurse crop in alfalfa

Grazing to control weeds

- Must balance weed competition vs. damage by animals
- Moisture key issue-Soil compaction
- Grazing also reduces weevil infestation (eggs in stem)
- Timing/management is important

Grazing controlling Weeds

Clipping smothers

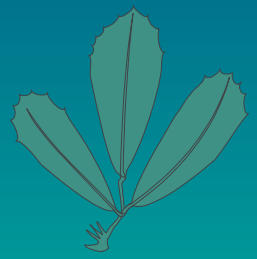
Grazing removes

Photo: Morgan Duran

Overseeding into Depleted Stands to Mitigate Weeds/weevil damage

'Overseed' – plant into existing older stands

- Grasses or berseem clover
- Also mitigates weevil damage
- Fills in and prevents weed intrusion
- Extends life of stand
- Changes market



Traffic

- Compacts Soils (root diseases)
- Reduces water infiltration
- Reduces vigor (weed competition)
- Reduces yield (20-30%)
- Causes Stand Loss (weed intrusion)

Equipment sanitation:

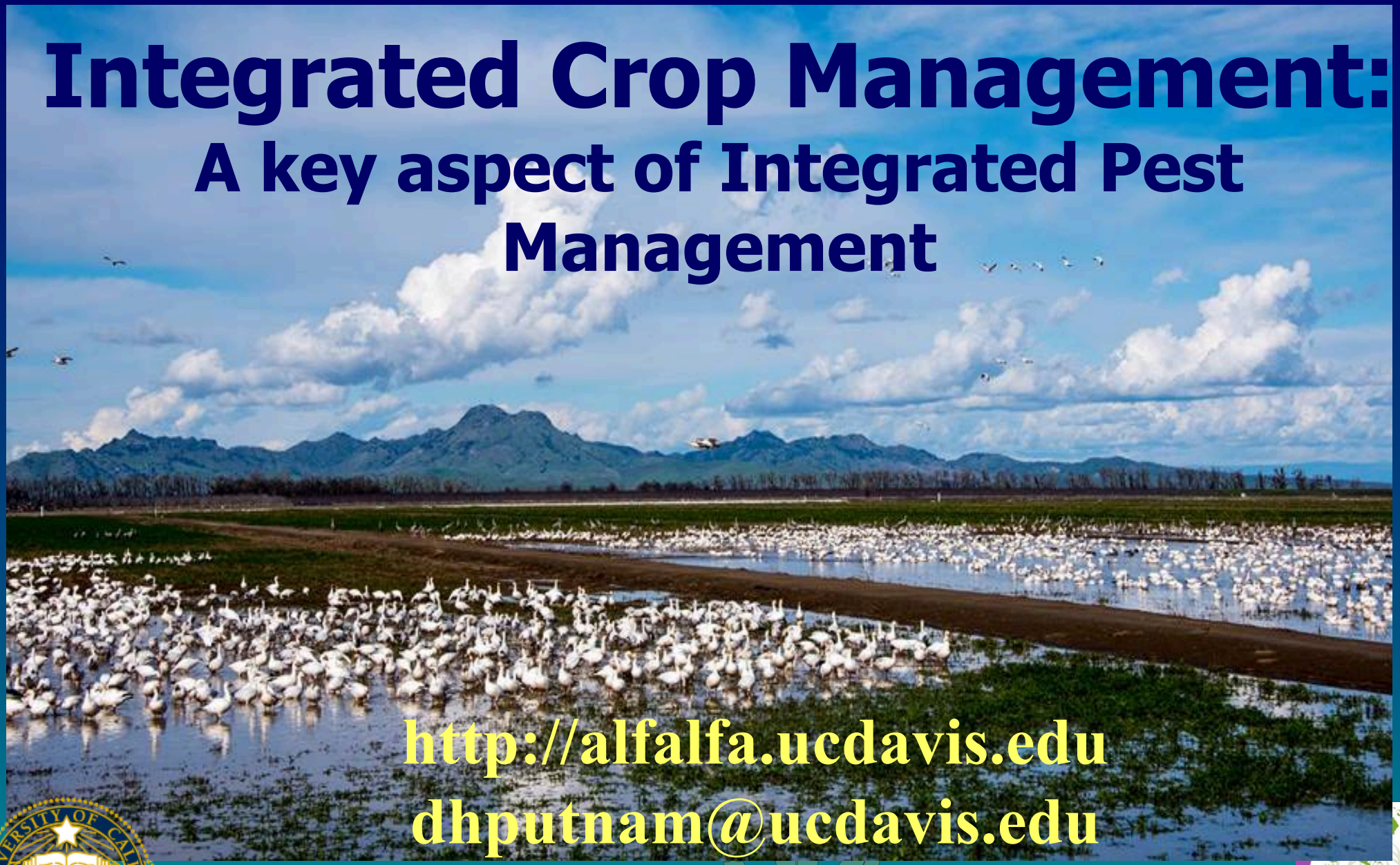
- Clean equipment between fields

Stem nematode

Summary:

- There are a series of agronomic practices that have profound effects on pests
- Key areas are
  - Stand Establishment Skill, timing, Soil Prep
  - Improving Soil Fertility for plant vigor
  - Variety Selection for pest resistance
  - Careful Irrigation Management
  - Harvest Management to improve persistance
  - Cropping Systems (Rotation)
- 'Integrated Crop Management' approach to pest management

Integrated Crop Management:
A key aspect of Integrated Pest Management



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