Plumerias:
GROWING IN COLD CLIMATES

- The experience of an isolated hobbyist over a 15 year period
- Dealing with frosts and freezes
- Notes from the web groups

Sub Titled

What to do with your plumerias if you move from perfect SoCal plumeria weather

- What you tell your relatives when you send them cuttings

Cold/High latitude growing

- CHALLENGES
  - Less photons per square inch hitting leaf
  - Shorter summers-on avg 180 days of sun
  - Temperature swings 50 degree swings several times in spring and fall
  - Low evaporation rates(usually)
  - Much colder on average all the time
  - Many Freezes/Frosts
  - High humidity with colder weather in KC

Surviving Freezes and Frosts

Kansas City has roughly 100 freezes a year not counting frosts

At least 30 days total under freezing completely each year.

Our freezes can last 200 straight hours

Interior Continent-harsher than edges of the country –record low

-22F, record high 112F

Plumerias out from May to October

Personal History

- Rec'd a cutting in 1986 as gift, the person said, these plants smell really good! it died.
- Went to Hawaii in 1994, got dime store cutting. Got cutting from Hawaii dime store, didn't know which way was up. Put it in soil dug out of yard. Six months later I realized it wasn't going to make it
- Went to Kansas City garden show, no one there knew what a plumeria was (!)
- **THIS IS WHERE MOST PEOPLE QUIT IN COLD CLIMATES I THINK**
- Out of frustration, I decide to get another one...
- Learned about the PSA from Book Gardening by Mail, joined the PSA in 1994

Failure failure failure

- Rotted easily over 150 cuttings from 1994-1998
- Never knew why-no one to ask!
- 3 years to bloom
- Bare-root storage killed many newly rooted cuttings
- Many plants would put up inflos, then they would drop them right before blooming
- Root rots, stem rots
- Got better when I built my greenhouse in 1998

Personal History

- Did bare-root storage in basement, lost Lei Rainbow, and a few others. Tried to contact Richard Eggenberger to find out what happened.
- $30 a piece, losing them was losing a lot of money! No society sales!!!! All mailed in!
- Decided to build a greenhouse
- Bought section of professional Stuppy greenhouse, $2300 later...

Greenhouse (Success success success!)

Greenhouse

- Gave me the equator in my backyard
- Great light in fall, winter and spring
- Control of nighttime heat
- Almost lost everything twice when heater failed
- Most plants bloomed all year around after that as long as it was warm and I watered

“Amy” in 2000

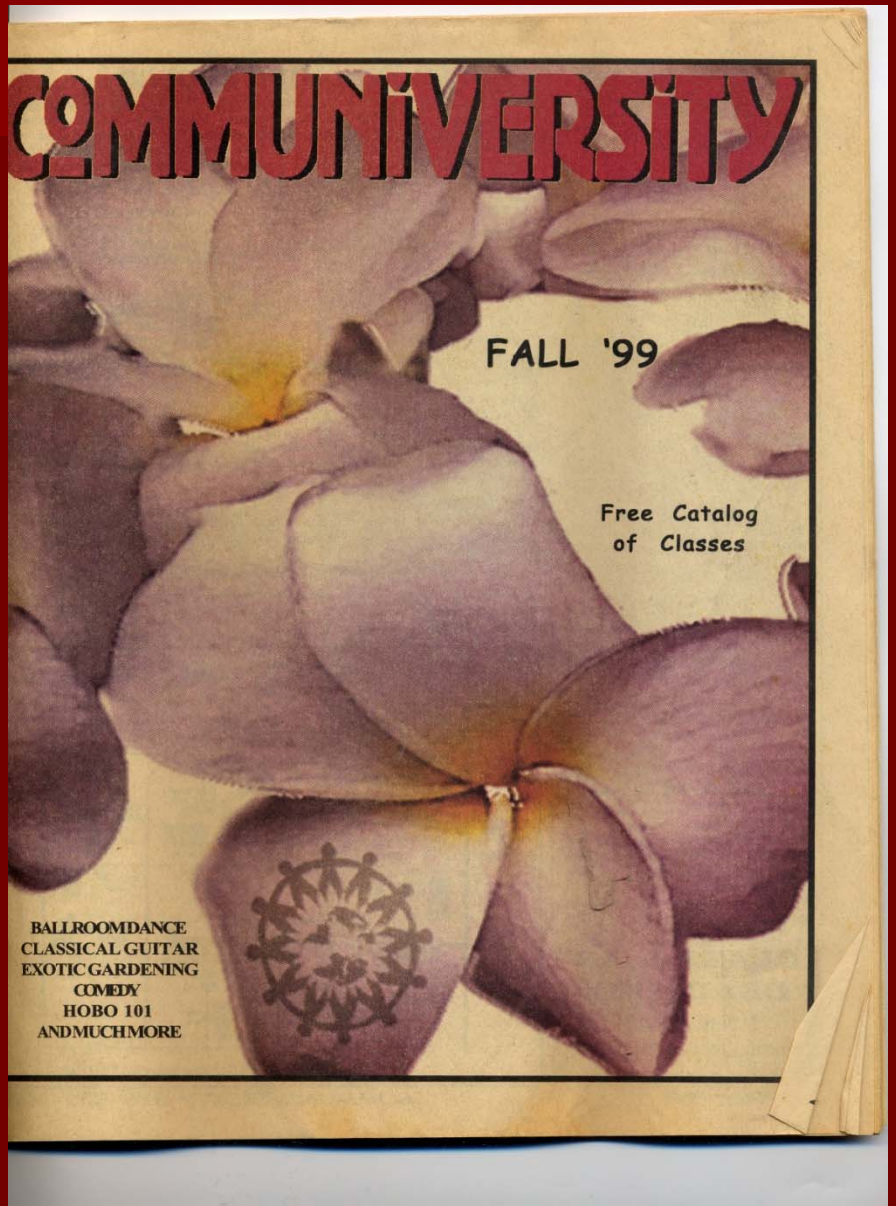
Samoan Fluff- 4 years old

Greenhouse grown Lurline

1 gallon JL Bridal White

Kimi Morange Greenhouse

Taught Adult Education Class



Adult Education Class

- Off-shoot of UMKC
- Taught 100 students over 3 years
- Learned that most people were not keeping their plumerias alive for more than a couple years at most
- No one knew why
- I noticed heat in my greenhouse at night was key –above 60F

Failures Spawned Experiments

- Started temperature experiments
- Over the next few years, found out they could bloom year ‘round if kept at 65F at night **and** watered.
- Later found out this was very similar to Singapore, where it is wet during the winter
- I have had blooms every day of the year now for 8 years

Pyrometer for measuring leaf temps

- AKA infrared thermometer

Collection right before web groups

1999-2000 Rise of the Web Groups

- Knowledge spread like never before
- The category “Cold Climate grower”
- Murky things became more clear like Cultivar strength (reds are wimpier in all climates) and warm growers had much less problems as a rule than cold growers
- The larger picture took shape!!!!
- Noticed people in SoCal were keeping them alive in cooler weather…
- Why was this? Dry winters!

Plumeria Pals

- Consider ourselves primarily as “observationalists” of plumerias
- Much like the astronomer Tyco Brahe who observed correct things in the sky but could not prove them mathematically
- Until he joined forces with Johannes Kepler who then proved the observations with mathematics
- We tried to start a science forum called Plumera TC (technical communication) but the science folk are not big posters

Plumeria Pals Moderators Scott, Ken

Plumeria Pals Yahoo Group

- Archive of 143,000 posts
- From climates all over the world
- Primarily a hobbyist group
- With lots of help sent a 100 cultivar shipment to Oz in 2001
- Ken brought Cooktown Sunset into cultivation in North America
- Members sent cuttings to pathology labs

Still making mistakes

- I lost 29 grafted cuttings when I put a 5% solution of Clorox on the roots to “disinfect” them from fungus. (2003)
- Ok. I knew not to do that again.
- I was still focused on defeating diseases as the solution to the problem. I had a conversation with a plant pathologist at Kansas State. She said as long as the plant is out of its normal habitat, it is vulnerable to getting sick. More and more fungicides are not going to help. AHA, the environment needs to be better!!

Drama! Have to move, no more greenhouse!

- I got married, started a family, and we moved.
- HOA not allow greenhouses. What to do?

An Empty Garage hmmmmmm

And a VERY understanding spouse

Garage Storage: Problems resurfaced

- Had 52 seedpods that summer
- Lost all but 10 after they went in the garage
- Garage had no windows (!)
- I needed to do something **-more light!**
- Black tip was coming back too

Indoor Lighting/Hydroponic Rooting

- During the winter I would search for a way to get them to root every time, some trigger, some way to get them to overcome their own built in limits
- I lost about 20 cuttings I was trying to water root
- Others in warm areas not reporting the problems I was.
- Decided to grow them in a hydroponic system under HID lights
- Nothing remarkable until I added an aquarium heater.
- When the temperature reached 80F in the water, they started to grow!
- About the same time more buzz on bottom heat.

Hydroponic Rooting

Hydroponics

- Water rooting worked well once I started using a aquarium heater
- Was heavily dependent on time of year and cutting variety, or if mailed
- If was taken right off the tree –Passive system most used
- Used LOTS of fungicide

Indoor Lighting/Bottom heat is the answer!

- A friend of mine from San Antonio, a fellow experimenter Lindell Tate, had been experimenting also, he said, “I have been working with waterbed heat mats, bottom heat is the trick
- From my own experience watching them come alive with the aquarium heater, I knew he was right

Indoor Lighting/Heat mats

- I got my old heat mat out, put cuttings on it and was rooting them under the 1000 watt Metal Halide all through winter

- Time of year no longer a factor in rooting cuttings

Indoor Lighting/heat mats

- Reason heat mats are so good is that they simulate the soil temperature of 80F in summer (4-6 inches deep) where the day/night variation is no more than 10 degrees

- Plumerias, specifically cuttings, do not like wild temperature swings. This, we found out was why they can initially start out well on concrete, but then as the summer moves on, stall out and even shock as the root zones approach 105F

HID=High Intensity Discharge

- Decided on HID lighting.
- HID lighting = High Intensity Discharge
- A few types, ones used for plants are called High Pressure Sodium(red spectrum) and Metal Halide(blue spectrum)
- First winter I experimented with both.

1000 watt light rooting cuttings in off-season

- Metal Halide GREAT for ROOTING cuttings

Indoor Lighting

I also used fluorescent lighting –on 12-14 hours a day.

Results were not great...needed more light

Plants kept leaves, seedpods fell off, still had issues of black tip

High Pressure Sodium light =no leaves, FANTASTIC inflo initiating

Metal Halide =excellent growth at tips, plants still bloomed

80F Optimal in Root Zone

- I have measured the soil temperature in my backyard in June (80)
- Eva in TX has measured hers. (80)
- Sean Miller went to Costa Rica, measured soil 6 inches down next to a mature plumeria tree with a digital thermometer, 79F
- Eggenberger says 80 is optimal in HBPC

Indoor Lighting/bottom heat

- The bottom heat/24 hour lighting would work 95% of the time, at any time of the year
- Essentially what we were doing was forcing them to root, convincing them it was summer
- The trick was to keep them watered
- Once a week

24 hour Lighting –Is this crazy?

- I had known about people using 24 hour lighting, Eva a few others on internet
- Lots of controversy, “It will kill them” A least 2 commercial growers told me “Plants need a dark cycle, botany hasn’t changed that much”
- I decided to try it, because you never know something until you try it yourself
- Results were amazing, plants kept blooming, growing leaves, initiating inflos
- Up to 6 feet away from light
- It wasn’t until a few years later that I realized I was keeping them growing, and from dormancy, and **dormancy** is were most of the problems show up.
- Can leave inflos on and root at the same time

Calvin Cycle

- People will usually say, plants need a dark period!
- They are referring to the Dark cycle or the Calvin cycle
- The word “Dark” is a misnomer. It was used to distinguish it from photosynthesis, which IS dependent on light.
- (L. Taiz and E. Zeiger, **Plant Physiology**, 2nd ed., 1998)

Samoan under 24 hour fluorescents

Same samoan Fluff 6 years earlier

Mardi Gras blooming as a cutting under 1000 watt MH in January

84f in perlite during winter

High Pressure Sodium

HPS “Dandelion” inflo

High Pressure Sodium

- HPS GREAT for initiating inflos!!!

Robotic Mover

Heater in garage
Installed natural gas line and a water line(hot and cold)

Bali Whirl blooming under lights

From seed to bloom INDOORS in 7 Months

Seed to bloom 7 mos

- Accomplished by Robert Walsh of Pals
- Chicago area
- Done in heart of winter Oct ‘07- April ‘08
- Agrosun 1000 watt metal halide
- Light left on for 16 hours a day, every day
- Room air temperature 80F day and night
- Used seaweed extract and gib acid

Bottom Line

- Essentially what I and others had done is prevent them from going dormant.
- **Preventing dormancy** is the best way to prevent problems from occurring in container plumerias.
- You keep them in “grow mode” and they grow thru problems, it is that simple

Preventing freeze damage

- At the smallest level you are trying to keep the ice crystal that is forming ON the leaf from growing into the cell membrane and bursting the cells in the leaf.

This involves knowing a little about radiational heat transfer and convection

Frosts/Freezes

- Step one in Kansas City, we don't let them experience the frosts or freezes – everybody inside if small enough!
- You guys live with an occasional freeze, like we do in Kansas City in the month of October.
- Here is what we do for those situations:

Superbloom/Freeze Pruf

- You can apply Super Bloom fertilizers on your plumerias as the cold winter approaches, this will give them added cold tolerance. But sometimes I forget this.
- Also, you can apply products like Freeze Pruf to protect them. This can get expensive. But sometimes I forget to do this too, so...

Then what?

- Watch the weather on tv
- Determine if temp will get down to 36-37F
- Nucleating bacteria on the leaf will cause frost to form at 36F-37F It provides sites/points for the ice to form on the leaf(makes it easier for ice crystals to form)
- And low winds-will keep warm air layer from replacing colder air layer on top of leaf/tip.

Step 2

- Determine if it will be a **clear sky**
- -a cloudy sky will block heat transfer to outer space from plumeria. Cloudy skies are good at night in cool weather.
- A clear sky will increase heat loss(transfer) to outer space geometrically
- This is what is called **radiational** heat loss or infrared photons carrying heat from the plumeria into outer space.

- Get them under an eaves up against the house or under a tree with leaves to block the heat photons from going from the top of the plumeria into outer space-which will cool the plumeria down

- Cover with a cloth blanket, sheet or tarp. Not plastic. Plastic (bags, sheets) don’t block of the infrared wavelength heat photon from going into outer space.

Frost Covering in October

Step 3

- If wind is blowing, nucleating sites for ice crystals to form will not be able to form. You could get a fan and blow it across the canopy.

- Think of water, if the water is moving, it is harder for it to freeze. The wind in a frost works the same way

If disaster strikes

- And you miss protecting them, get a hose and SPRAY OFF THE FROST as soon as you can in the morning. The water temperature will be 60F and will warm the leaf.

- I have done this and it doesn’t hurt them

If you get lucky, your trees get big

San Germaine Giant

Wind braces for large trees

Taking apart fence

Moving to garage

26’ U-Haul


U-HAUL
ONE-WAY & LOCAL RENTALS
"The van that rides on air"
NEW MEXICO

Backyard Top

Backyard Center right

Backyard Center Left

Back yard bottom of hill left

Moving back to garage for winter

Bringing them inside

Coming in November

Bringing inside on Nov 4th

Full Garage

Bringing them back out in May

Giant –root pruning with hack saw

Latex Paint whitewash

Lurline

Musk Rainbow

Moragne 93

Charlotte Ebert my all-around favorite

St. John’s Rainbow

Darwin Sunset and tag

“AMY”

Notes from the Plumeria Pals on Yahoo Groups

Notes from 9 years of internet

Grafting

- I prefer grafted cuttings.
- I believe all growers should sell them to cold weather growers.
- It avoids a long wait-2-3 seasons until blooms
- It makes the plant much tougher in first winter to temp swings, over watering stress, pot stress... providing you have a good seedling rootstalk

Do Better Grafted

- Lurline
- Daisy Wilcox
- Katie Moragne
- Edi Moragne
- Mary Moragne
- Bill Morange
- Dwarf Richard Criley
- Vera Cruz Rose
- Singapores
- Wildfire

Grafted comments

- Esteban McGrath, a grower in Puerto Rico
- Says he recommends for immediate grafting Bill Morange, Hilo Beauty, Filifolia
- Luc sells only grafted
- Costa Rica, Lurline
- Ken, Ampol, Uplands in LA, FCN

Tough Plumerias

- Slaughter Pink
- Samoan Fluff
- San Germaine (most cold tolerant)
- Plastic Pink
- JL Bridal White
- Sherman
- Grafteds

Soil Experiments

- Screen for fines
- Fines clog up pot, create dead zones
- Small 1 gallon pots, nothing organic that will degrade, larger than 1/8 inch
- Volcanics
  - Coarse perlite
  - Scoria
  - Pumice
- Ag Granite
- Pine Bark mulch with fines screened

Soil Experiments

- What didn't work so well
- Peat(works less well higher the lat.)
- Compost(in the mix)
- Manure(top dress ok)
- Depends on watering habits, evaporation rate, soil compaction, element size
- Plumerias will show smaller leaves, thinner branches, branch dieback, if roots are not happy

Characteristics of Superior Cuttings

- Hard to the touch
- Mother tree is not stressed from too much water-why SoCal cuttings superior!
- If from container, plants were not over watered
- Can root with leaves
- From root bound plants in containers
- Most always connected to cultivar strength
- Not off the tree very long-Ampol grafting success goes down 10% if cutting has been mailed

Black Tip Rot

- I have sent cuttings to labs on two different occasions
- Ken Ames sent 20 cuttings to Dr. Janet Uchida at U of H(plant pathologist)
- Another Pals member in Pennsylvania
- All indicated NO FUNGUS
- **BACTERIA ATTACK**

Black Tip

- A surface biome of bacteria lives on the plumeria, when plant becomes stressed, one bacteria colony decides to attack the plant(Opportunistic infection)
- Ways to avoid this
- Keep them from temperature swings
- Keep them warm in winter at night
- Only buy tougher varieties
- Keep mix light, superfast draining

Black tip Solutions con't

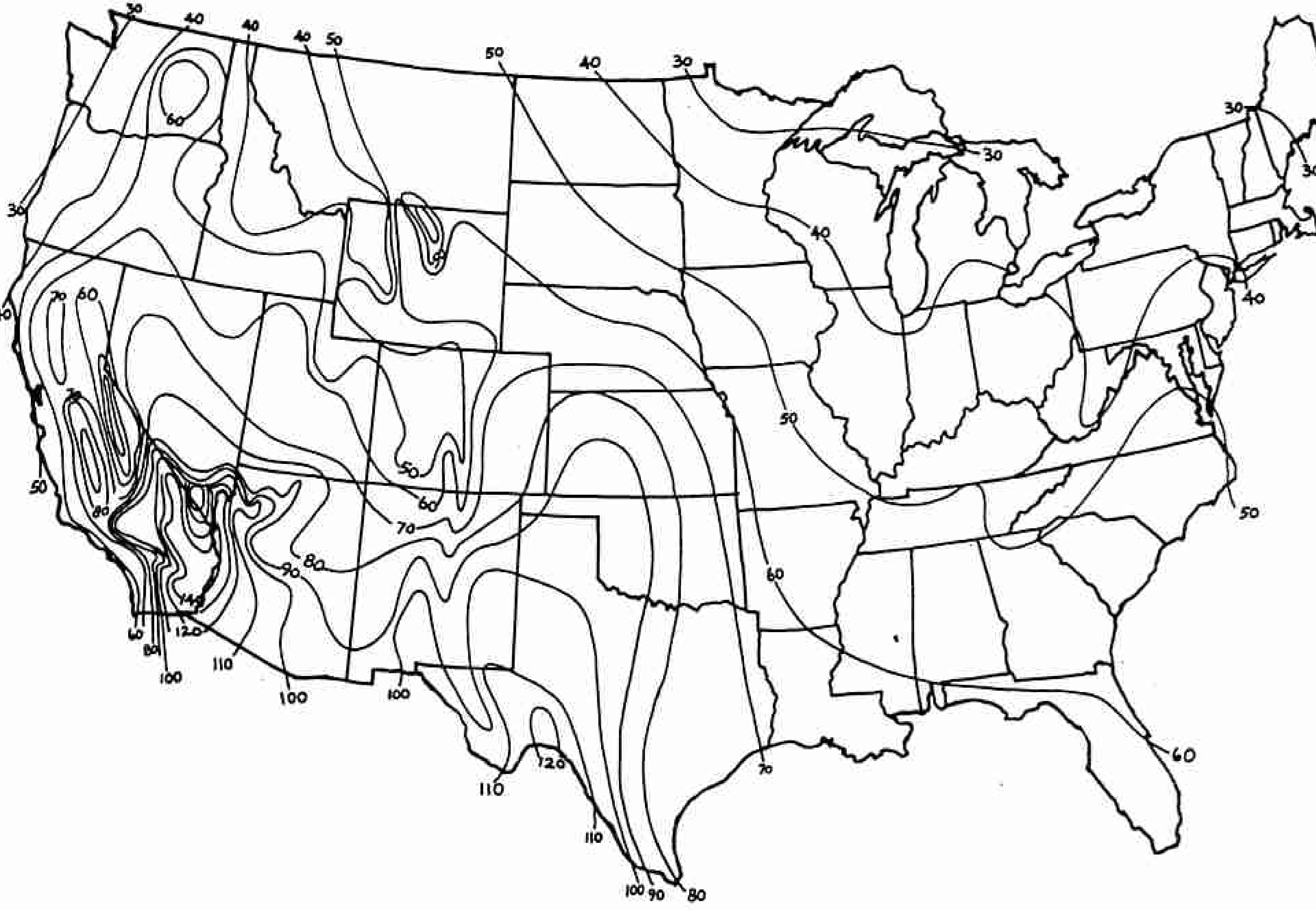
- Fan 24 hours
- Dry air
- Air temp of at least 60F
- Little water
- Good draining mix
- Alcohol on tip (per Eva)
- H2O2
- 24 hour lighting(keeps them from dormant)

Heat Length Threshold

- Plumerias will not grow at Volcano, Hawaii where the temperatures at 65-70F during the day and 45 at night year ‘round.
- Even though they will grow survive in warm climate winters in these temps
- They will not survive year around at them
- If they get cold at night for a period of weeks, they need a warm up in the day
- HUGE THING for warm growers to understand about cold weather growing

Evaporation Rate

- Plumerias prefer higher evap rates, as a rule in container growing
- Less issues with water in the container
- Higher evap rate usually means more sunshine=happy plumerias
- Southwest US has highest evaporation rates
- Less problems with rust and bacteria rots



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Evaporation Rate

- Higher the rate, the lower incidence of rotted cuttings, in general
- Higher rate coincides with least issues of bacterial rot (especially in winter)
- Higher rate with the least amount of rust fungus
- Mixes can be adjusted and temperature rules can be followed

Evaporation Rate

- Why is this?
- Plumerias evolved in a climate where their needs for sun and heat were optimal, but they had to adjust to long periods of drought.
- Stem succulents are seen by some scientists as freaks of evolution
- Their weakness is cold and wet, they have limited defenses against it. Cold meaning long periods below 60F without daytime warm up

Blooming in Shade?

- Several reports have shown plumerias will bloom in shade.
- Most of these reports are from the tropics.
- I measured with my light meter the scattered light at the edge of shade and full sun...and as you can imagine, there are different “shades” of shade. The light on the edge of full sun is approximate to the light under fluorescents, which in my garage will bloom plumerias.

“Cactus” Group (low water)

- Singapores (incl. Mele Pa Bowman)
- Lurline
- Cooktown Sunset
- Kulanani
- Vera Cruz Rose
- Aztec Gold

(Source: Warren in So Cal)

Rotter List

- Lurline
- Dark Reds
- Aztec Gold
- Celadine(Can turn into a rotter)
- Singapores

If I Had to Do It Over

- Would have bought large trees
- Would have built a greenhouse at the beginning
- Would have used a heat mat for cuttings
- Would have used 24 hour lighting
- Would have used a lighter mix
- Would fertilize every 2 weeks
- Grafted cuttings only
- Would not have watered as much
- Kept them warmer warmer warmer
- Use seaweed extract
- Use more potassium and less nitrogen (6-30-30)