Late Season Management Decisions – Final Irrigation and Harvest Prep

Dr. Randy Norton
The University of Arizona
Safford Ag Center

Late – Season Decisions

- Goals
  - Manage crop for optimum lint yield and fiber quality
  - Maximize economic returns
    - Efficient crop termination – point of diminishing returns
      - Constraints related to weather (HU accumulations)
    - Efficient harvest prep through defoliation and boll opening
      - Earlier harvest prep typically more efficient

Concept of Irrigation Termination

- What is the goal of efficient irrigation termination?
  - Maximize yield
  - Optimize water efficiency
  - Mature bolls
  - Point of diminishing returns
    - Point at which additional input does not result in positive net returns

Crop Monitoring - Irrigation Termination

- Identify last fruit intended for harvest
  - point of diminishing returns
  - occurrence of cut-out
    - consider variety type
- Consider insect populations / pressure
  - SPWF, PBW, lygus, stink bugs, etc.

Irrigation Termination Decision

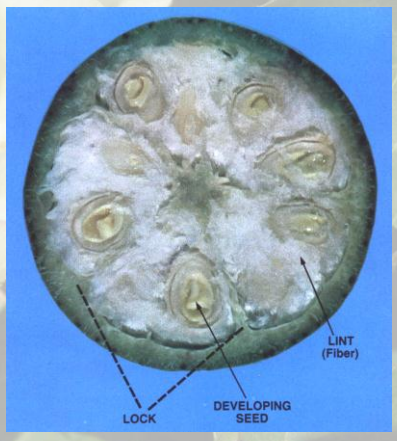
- Identify last flower to be taken to harvest
- Determine the amount of time for that flower to mature into a harvestable boll
- Must provide sufficient soil water through fiber elongation phase (~600 HU ~21 days / Aug. and Sep.)

ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Boll Maturity

- All harvestable bolls are mature (cut bolls with a knife)
  - seed coats are brown
  - small leaves are visible in the seeds
    - no green jelly in the seeds



ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Boll Development and Maturation

600 HU

400 HU

Fresh Bloom

Full sized Hard green Boll

Open Boll

ARIZONA COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

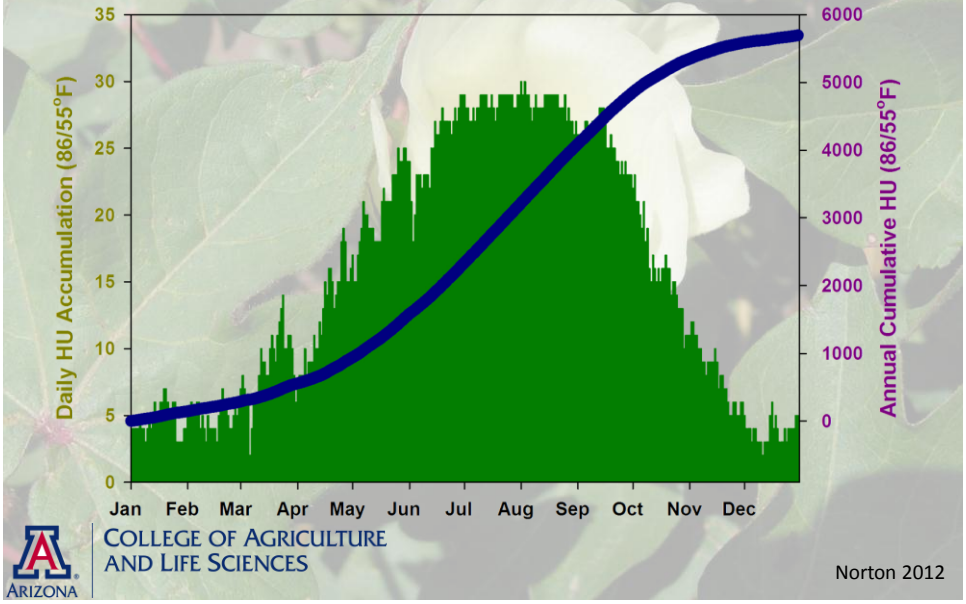
Boll Maturity

Boll slicing of first position bolls beginning with a mature cracked boll on the far right to the least mature boll in this image on the far left (NCC, 2007).

ARIZONA COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

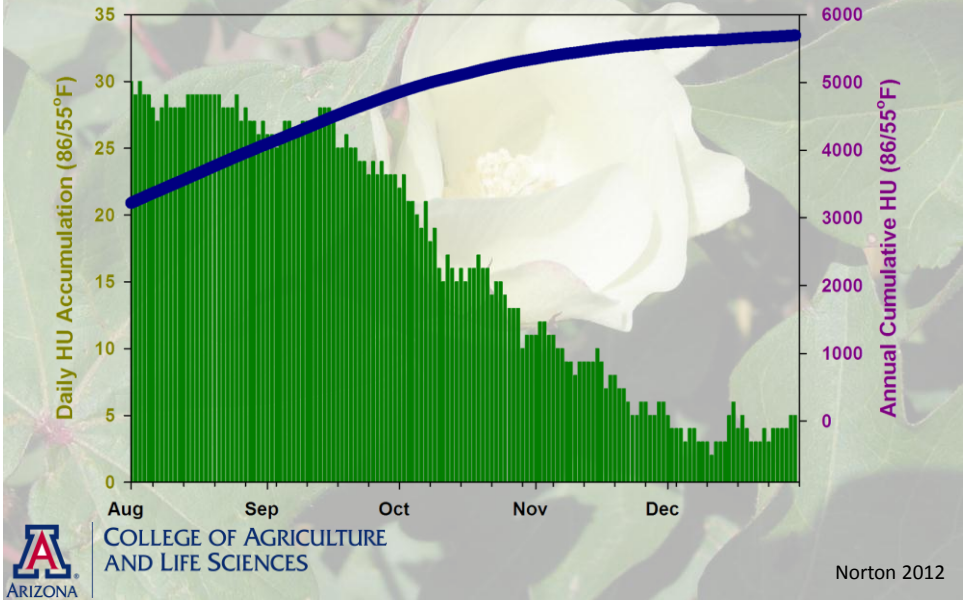
Normal HU Accumulations



ARIZONA COLLEGE OF AGRICULTURE AND LIFE SCIENCES

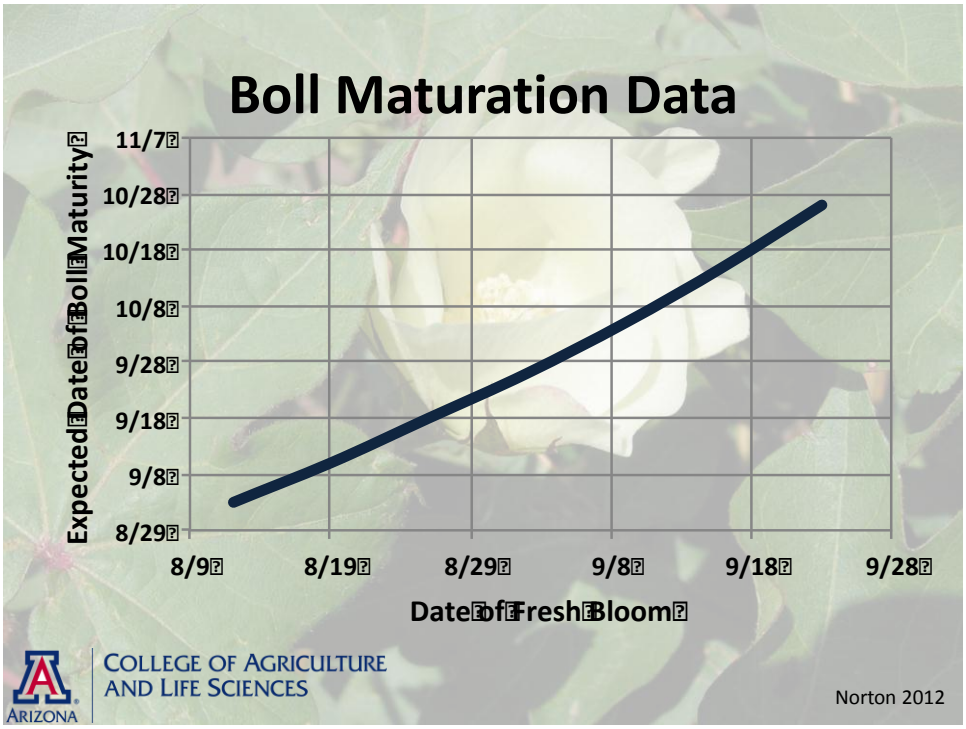
Norton 2012

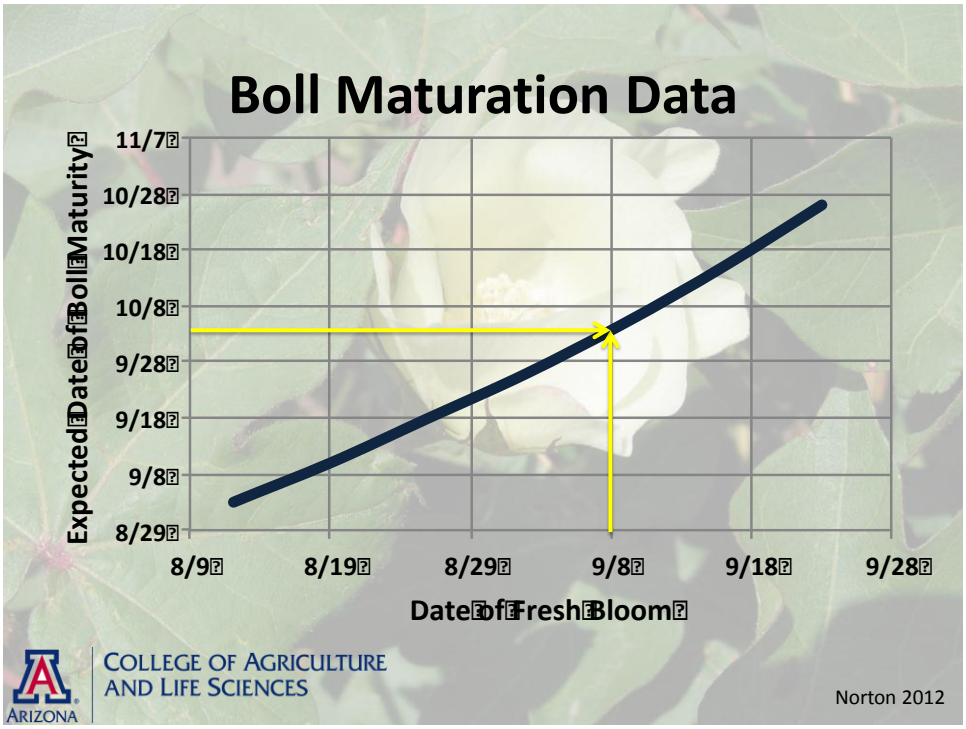
Late Season Heat Units



ARIZONA COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012


Boll Maturation Data
Expected Date of Boll Maturity
11/7
10/28
10/18
10/8
9/28
9/18
9/8
8/29
8/9
8/19
8/29
9/8
9/18
9/28
Date of Fresh Bloom
COLLEGE OF AGRICULTURE AND LIFE SCIENCES
ARIZONA
Norton 2012


Boll Maturation Data
Expected Date of Boll Maturity
11/7
10/28
10/18
10/8
9/28
9/18
9/8
8/29
8/9
8/19
8/29
9/8
9/18
9/28
Date of Fresh Bloom
COLLEGE OF AGRICULTURE AND LIFE SCIENCES
ARIZONA
Norton 2012

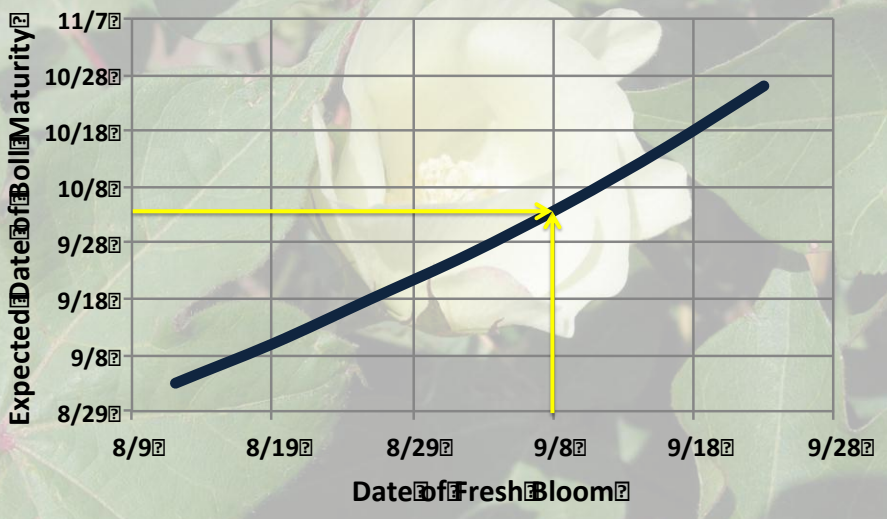
Irrigation Termination

- Scenario
  - Crop planted on 4/10/12
  - Last flower identified for harvest on 8 SEP
  - On average should mature on 5 OCT

COLLEGE OF AGRICULTURE AND LIFE SCIENCES
ARIZONA

Norton 2012

Boll Maturation Data



COLLEGE OF AGRICULTURE AND LIFE SCIENCES
ARIZONA

Norton 2012

Scenario – cont.

- Irrigation occurred on day of final flower identification – 8 SEP
- Water use for that period
  - 8 SEP – 5 OCT…
    - Approximately 6.05" water
  - Average soil will hold 2" plant available water (PAW) per foot
  - x 3 foot effective rooting depth
  - = 6 inches of water holding capacity

Scenario - Continued

- Irrigate @ 50% PAW or 3" depleted
- Average water use would deplete 3" in approximately 12 days
  - Final Irrigation on 8 SEP plus 12 days = 20 SEP

Defoliation Goal

- Single defoliant application
- Satisfactory defoliation (>75%)
  - with good top-growth control
- Manage for picking high quality lint

- Good progress in the past 10 years
  - Dropp, DEF/Folex, Accelerate, Ginstar, Na Chlorate, etc.

Defoliation

- Management to enhance a natural physiological process
  - senescence (aging)
  - abscission layer development
  - leaf drop

- Yield
- Quality

Defoliation – 4 Main Goals

- Defoliation of mature leaves
- Control of regrowth
- Mature boll opening
- Juvenile growth control

Steps to Successful Defoliation

- Final irrigation
- Crop Evaluation - complete maturity
- Selection of defoliant material
- Timing of defoliant application
- Allowing appropriate time
  - following defoliant application
  - 14 days

Defoliation - Related Factors

- Plant-water relations
- N fertility status
- Honeydew deposits on leaves
- Weather conditions
- Chemical defoliants

Water Stress / Defoliation

- Adequate
  - abscission layer formation
  - sustained physiological activity / defoliant
  - sufficient green leaf weight
    - break through abscission layer
    - accomplish leaf drop (shear)

Defoliation Scheduling Techniques

- Late-season irrigation interval
- Percent open bolls
- Nodes above cracked boll (NACB)

ARIZONA COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Late Season Irrigation Interval

- General rule of thumb
- Apply defoliants at approximately 2X the normal late season irrigation interval
  - allow for current weather conditions and soil water holding capacity

ARIZONA COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Rule of Thumb - Example

- 14 day irrigation interval (late season)
  - 28 day (4wk) interval
    - last irrigation to defoliant application
    - may be earlier with
      - hot, dry weather conditions
      - good boll load (fast senescence)
      - coarse textured soil (low water holding capacity)

Percent Open Boll

- Most defoliants may be applied at 60% open boll without negatively impacting boll opening or fiber quality
- Care must be taken with Na-Chlorate
  - Need to be approximately <85% prior to application
  - Some bolls may be burned by application and not open properly

Percent Open Boll

- Perform evaluations in several field areas
  - Select field areas where crop stage is representative (make several counts across a field)
  - Select a row length (i.e. 2m) and count the total number harvestable bolls
  - Count the total number of open or cracked bolls
  - Divide the open or cracked number by the total number and multiply by 100 to get percent open boll

ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

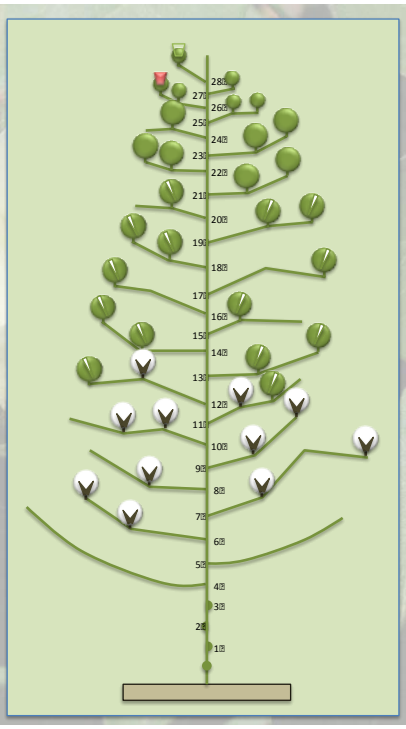
Norton 2012

Harvest Prep Guidelines Percent Open Boll

Total Bolls (mature) = 33

Total Bolls (open + cracked) = 25

Percent Open Bolls = 25/33*100 = **75.8%**



ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Nodes Above Top Cracked Boll

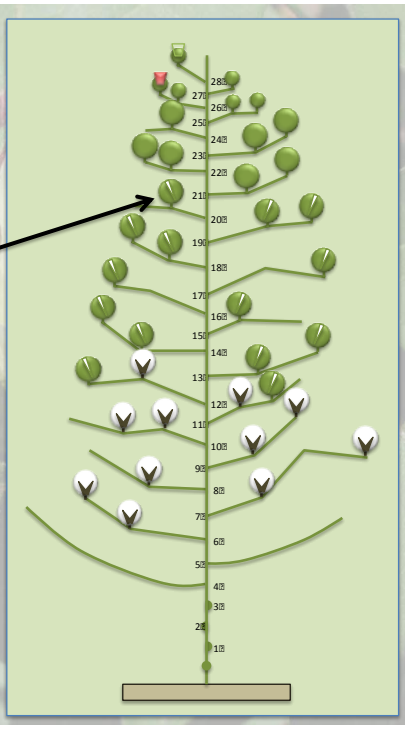
- Nodes Above (Top) Cracked Boll (NACB)
  - When NACB ≤ 4
  - Well correlated to percent open boll (>60%)
  - Caveat with desiccants (<85%)
- Top node = top node with a harvestable boll (boll intended for harvest)
- Count the total number of nodes above top, first position cracked or open boll (0) to uppermost harvestable boll

ARIZONA COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Harvest Prep Guidelines NACB

Upper-most first position Cracked boll

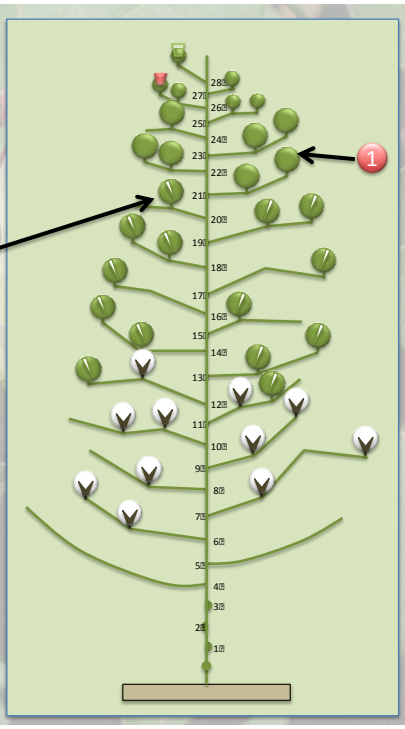


ARIZONA COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Harvest Prep Guidelines NACB

Upper-most first position
Cracked boll

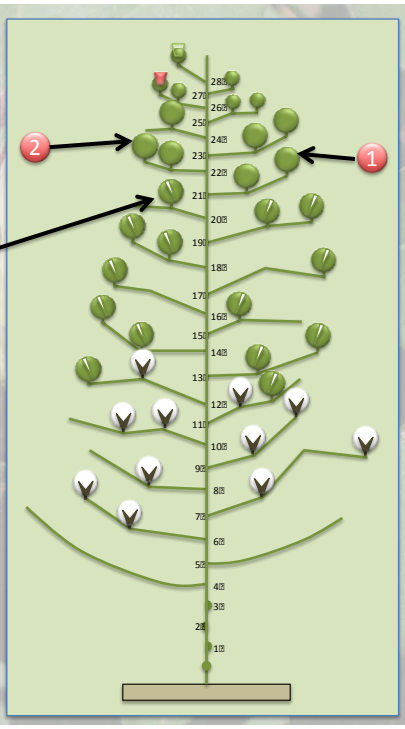


ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Harvest Prep Guidelines NACB

Upper-most first position
Cracked boll

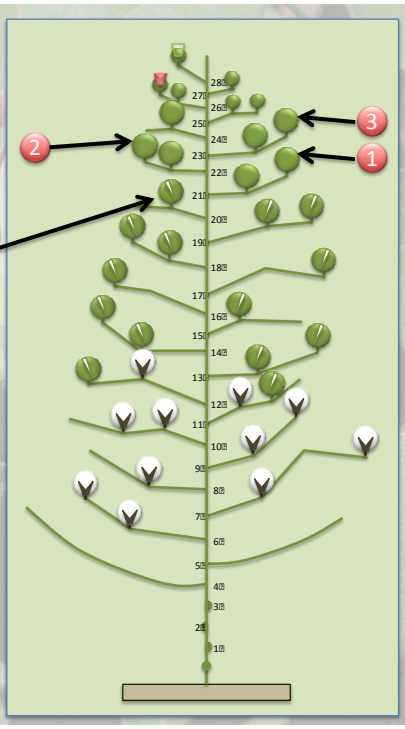


ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Harvest Prep Guidelines NACB

Upper-most first position
Cracked boll

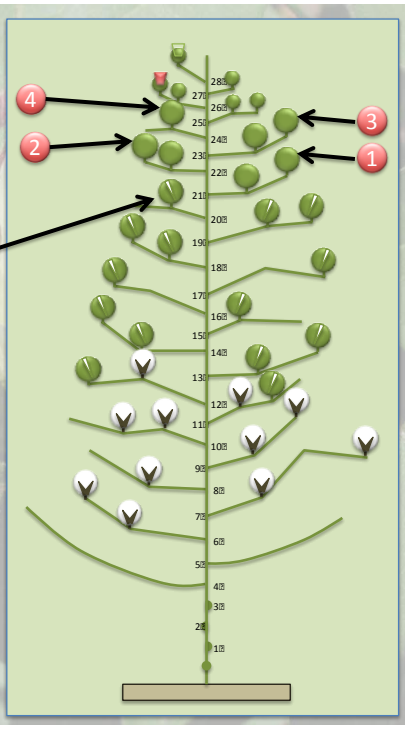


ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Harvest Prep Guidelines NACB

Upper-most first position
Cracked boll



ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Defoliant Application Rates - Temperatures (Based on Recommended Label Rates)

LOW RATES	MED. RATES	HIGH RATES
Hot Temps.	Med. Temps.	Cool Temps.
>300 HU 14d post-app.	200-300 HU 14d post-app.	<200 HU 14d post-app.
(~ 90°F+ day temps. ~ 70°F+ night temps)	(~ 80°F+ day temps. ~ 60°F+ night temps)	(~70°F+ day temps. ~ 40°F+ night temps)

ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Available Harvest Aid Chemicals

Type	Trade Name	Common Name	Manufacturer
Defoliant	Aim	Carfentrazone-ethyl	FMC
	Ginstar EC	Diuron Thidiazuron	Bayer CropScience
	Redi-Pik 1.5 EC	Diuron Thidiazuron	Manna
	Dropp	Thidiazuron	Bayer CropScience
	Def 6	Tribufos	Bayer CropScience
	Freefall	Thidiazuron	Griffin
	Resource	Flumiclorac pentyl ester	Valent
	ET	Pyraflufen ethyl	Nichino America
	Sodium Chlorate	Sodium Chlorate	Various
Boll Opener/Conditioner	Prep	Ethephon	Bayer CropScience
	Super Boll	Ethephon	DuPont Ag
	Ethephon 6	Ethephon	Micro Flo
	Boll'd	Ethephon	Agriliance
Boll Opener/Defoliant	Finish 6 Pro	Ethephon Cyclanilide	Bayer CropScience
	CottonQuik	Ethephon AMADS	NuFarm
Desiccants	Sodium Chlorate	Sodium Chlorate	Various
	Gramoxone Inteon	Paraquat Dichloride	Syngenta
	Parazone 3SL	Paraquat Dichloride	Manna
	Firestorm	Paraquat Dichloride	Chemtura

ARIZONA | COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012

Expected Activity of Harvest Aid Materials

Harvest Aid Material	Defoliation of Mature Leaves	Control of Regrowth	Boll Opening	Effect on Juvenile Growth
Aim	●	○	×	●
Thidiazuron / Diuron	●	●	×	●
Thidiazuron	●	●	×	●
Tribufos	●	○	×	○
Resource	●	○	×	●
ET	●	○	×	●
Ethephon	◗	○	●	○
Ethephon + Cyclanilide	◖	◗	●	◖
Ethephon + AMADS	◖	◗	●	◖
Sodium Chlorate	◖	○	×	◖
Paraquat	×	○	○	●

● Excellent activity
◖ Excellent to fair activity
◗ Fair to poor activity
○ Poor activity
× No activity

ARIZONA COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Norton 2012