From:	Stelly_David
To:	Stelly_David
Cc:	Rooney Bill; Mullet John; Avant Bob; McCutchen Billy F
Subject:	Re: pics of hybrids (clean gh)
Date:	Tuesday, September 15, 2009 6:08:08 PM
Attachments:	P1000354cropd.jpg

On Sep 15, 2009, at 6:04 PM, Stelly_David wrote:

> <P1000341.JPG>

From:	Kuhlman, Les
To:	Bill Rooney
Subject:	RE: registration manuscript
Date:	Monday, August 31, 2009 9:31:11 AM
Attachments:	Tx3361 Registration Manuscript.doc fig1 copy.jpg

---

Bill-

Attached is the registration manuscript with my address in it. I don't have any other changes.

I found a copy of the original figure - it is also attached. Let me know if you need anything else, thanks,

Les

Les Kuhlman
Research Scientist
Pioneer Hi-Bred International, Inc.
Lawrence Soybean Research Center
1451 North 1823 Rd
Lawrence, KS 66044
Office: (785) 841-2229 x11
Cell: (785) 764-2186

From: Bill Rooney [mailto:wlr@tamu.edu]
Sent: Friday, August 28, 2009 5:10 PM
To: Kuhlman, Les
Subject: registration manuscript

Man, you are publishing fool these days.

I think I mentioned that we are go to release and publish the registration manuscript on Tx3361, so I've taken the liberty to finish that manuscript. It is attached and needs a little information from you and any addition editing you might wish to manage.

If you have the original image for the figure, can you send it to me? They may want something with a little higher image quality.

Like the Genome paper, I'd like to get this submitted next week in conjunction with our sugarcane paper, so your input soon would be greatly appreciated.

regards,

bill

Dr. William L. Rooney
Professor, Sorghum Breeding and Genetics
Chair, Plant Release Committee
Texas A&M University
College Station, Texas 77843-2474

979 845 2151

From: Bill Rooney
To: "Owens, Vance"
Subject: RE: reports
Date: Wednesday, October 21, 2009 11:05:45 PM
Attachments: DOE Report Sorghum October 2009.docx

Vance

Please find attached a brief report for the October report. It's not perfect, but there is some data and summary of current activity.

I'll be out of e-mail contact for the next four days so I hope this is enough (I'm in Indonesia right now).

Regards,

Bill

From: Owens, Vance [mailto:Vance.Owens@SDSTATE.EDU]
Sent: Wednesday, October 21, 2009 3:49 PM
To: DoKyoung Lee; Rooney, William
Subject: reports

DK and Bill:

Will you be able to get your RFP CRP and sorghum reports to me by tomorrow? I need to submit the total report to Jim by tomorrow afternoon if at all possible since I will be out of the office on Friday.

Thanks,

Vance

Vance Owens
Plant Science Department
South Dakota State University
1110 Rotunda Lane North
244C SNP, Box 2140C
Brookings, SD 57007

Office phone: 1-605-688-6088
Fax: 1-605-688-4452
email: vance.owens@sdstate.edu

Sorghum: W.L. Rooney, Texas A&M University, Sorghum Coordinator

Objective: Establish and perform replicated field trials of energy sorghums to gather biomass production and sustainability data that documents biomass yield at different regional locations for assessing potential expansion of sorghum as a bioenergy feedstock resource.

Planned Activities:

1. Harvest, collect data and biomass samples from the 2009 cropping season.
2. Complete analysis of 2008 data and submit to Oak Ridge National Labs.

Actual Accomplishments:

1. Trials partially completed in most of the locations in the country. The sorghum trial in Corpus Christi, Texas was never planted due to extreme drought throughout 2009. All other locations were planted and grown and data will be collected. At this time, approximately ½ of the locations have been harvested; the remainder should be completed by the end of October.
2. Data collected from 2008 was compiled and submitted to Oak Ridge National Labs. (See attached Table).
3. Samples from 2008 were scanned and prepared for shipment to INL.

Explanation of Variance: Lack of funding is causing problems at some locations. Drought at some locations may reduce yield.

Plans for Next Quarter: Prepare for harvest.

Publications / Presentations/Proposals Submitted:
Biomass 2009. Washington DC.
National Sun Grant Conference. Washington DC.

Table 1. 2008 Agronomic performance of different sorghum hybrid across locations.

Location	height	fresh yield		dry yield		Dry	Brix
Entry	cm	MT/ha	ton/ac	MT/ha	ton/ac	Matter	%
Corpus Christi							
22053	167.6	29.5	13.2	15.0	6.7	0.50	.
84G62	147.3	31.4	14.0	13.5	6.0	0.45	.
Graze-N-Bale	254.0	69.9	31.2	23.0	10.3	0.39	.
M81-E	243.8	62.2	27.7	21.3	9.5	0.37	.
Grazeall 3	203.2	35.0	15.6	10.3	4.6	0.39	.
Sugar T	223.5	44.8	20.0	14.4	6.4	0.33	.
lsd	93.3	9.9	4.4	5.6	2.5	0.14	.

College Station							
22053	187.3	28.4	12.7	12.8	5.7	0.52	10.6
84G62	127.0	21.2	9.5	11.0	4.9	0.47	14.0
Graze-N-Bale	273.1	47.2	21.1	29.1	13.0	0.52	12.7
M81-E	241.3	43.8	19.5	23.1	10.3	0.53	13.4
Grazeall 3	200.0	27.0	12.0	13.9	6.2	0.51	15.4
Sugar T	244.5	33.2	14.8	16.0	7.1	0.44	10.7
lsd	36.9	6.6	3.0	6.7	3.0	0.16	7.2
Mississippi							
22053	274.7	22.8	10.2	7.2	3.2	0.31	.
84G62	70.3	11.1	5.0	5.0	2.2	0.45	.
Graze-N-Bale	362.0	41.8	18.6	11.4	5.1	0.27	.
M81-E	262.4	36.3	16.2	10.4	4.6	0.29	.
Grazeall 3	197.5	21.4	9.5	9.6	4.3	0.45	.
Sugar T	255.3	27.3	12.2	8.4	3.8	0.31	.
lsd	31.5	5.2	2.3	2.4	1.1	0.04	.
Kentucky							
22053	.	11.5	8.1	6.2	2.8	0.35	12.9
Graze-N-Bale	.	14.4	6.4	4.5	2.0	0.32	10.8
M81-E	.	21.4	9.5	8.0	3.6	0.38	9.1
Grazeall 3	.	9.1	4.1	4.3	1.9	0.47	11.8
Sugar T	.	6.0	2.7	2.6	1.2	0.43	10.8
lsd	.	12.4	2.0	2.4	1.1	0.03	4.3
North Carolina							
22053	.	38.4	17.1	11.7	5.2	0.31	8.0
Graze-N-Bale	.	55.0	24.5	14.1	6.3	0.26	11.0
M81-E	.	22.9	10.2	7.2	3.2	0.33	17.5
Grazeall 3	.	11.1	4.9	5.1	2.3	0.46	9.8
Sugar T	.	34.4	15.4	10.0	4.5	0.3	7.5
lsd	.	15.7	7.0	3.7	1.6	0.48	4.1
Kansas							
22053	341.9	45.9	20.5	24.7	11.0	0.54	.
Graze-N-Bale	339.9	74.4	33.2	19.5	8.7	0.26	.
Grazeall 3	276.2	37.8	16.9	27.1	12.1	0.71	.
Sugar T	341.2	68.3	30.5	15.7	7.0	0.23	.
lsd	19.9	11.1	4.9	4.8	2.2	0.06	.

From: Bill Rooney
To: "Emily Hallam"
Subject: RE: request for interview
Date: Thursday, October 08, 2009 2:27:29 AM
Attachments: Hallam edited by William Rooney.docx

Emily:

Please see the attached file for edits.

Regards,

Bill

From: Emily Hallam [redacted]
Sent: Wednesday, October 07, 2009 10:16 AM
To: 'Bill Rooney'
Subject: RE: request for interview

Dear Mr Rooney,

Please could you double check that you are happy with the facts/figures/quotations in the following excerpt of Biofuels International's 2500 wd article on sorghum. If there are any discrepancies in the text, could you let me know by Friday. Please note it is a rough draft, and the style may be subject to change, but the content is not.

Many thanks, Emily

William Rooney, Associate Professor of Texas A&M University's Institute for Plant Genomics and Biotechnology is currently developing a hybrid crop to overcome the key challenges which sorghum farming presents. Energy crop company Ceres has invested $5 million in an exclusive, multi-year joint research and commercialisation agreement for high-biomass sorghum. These hybrid plants are not designed to produce grain, but to yield vast amounts of biomass.

The process was started in the 1970s, when rising oil prices led to a flurry of research into heterosis of sorghum, but initial development efforts were shelved when the oil market recovered.

"Whilst sorghum hybrids have been around for a long time, this is the first time that a hybrid sorghum system is being developed specifically for the bio energy consumer market," says Rooney.

The heterotic sorghum substantially out-yields conventional sorghum. A&M is also working on expanding the range of the crop for earlier planting in cooler and drier conditions, especially on so-called marginal or unproductive land. According to Cesar Granda of Terrabon, A&M is also working on a low-lignin breed of sorghum, to eliminate the need for pre treatment altogether.

Ceres announced its collaboration with A&M in October 2007, but Rooney's research began almost a decade ago. "It should be available commercially in the next year, certainly by 2011," says Rooney. If the expectations are met, the new sorghums processed by next-generation conversion technologies could yield a whopping 2000 gallons/acre (18,800 l/ha) of cellulosic ethanol, more than four times the current starch-to-ethanol process.

Emily Hallam
Editorial Assistant
www.biofuels-news.com
www.tankstoragemag.com
[redacted]

From: Bill Rooney [mailto:wlr@tamu.edu]
Sent: 23 September 2009 13:41
To: 'Emily Hallam'
Subject: RE: request for interview

yes

Dr. William L. Rooney
Professor, Sorghum Breeding and Genetics
Chair, Plant Release Committee
Texas A&M University
College Station, Texas 77843-2474
979 845 2151

> -----Original Message-----
> **From:** Emily Hallam [redacted]
> **Sent:** Wednesday, September 23, 2009 7:35 AM
> **To:** 'Bill Rooney'
> **Subject:** RE: request for interview
>
> Dear Bill,
>
> Many thanks for your understanding, shall I call just after 10, say 10.15 on Monday morning? Is the telephone number to call the same as the one written on your email signature?
>
> I look forward to learning from your expertise!
>
> Emily
>
> *Emily Hallam*
> Editorial Assistant
> www.biofuels-news.com
> www.tankstoragemag.com
> (t)0044 (0)208 687 4183
> [redacted]

> **From:** Bill Rooney [mailto:wlr@tamu.edu]
> **Sent:** 23 September 2009 13:06
> **To:** 'Emily Hallam'
> **Subject:** RE: request for interview
>
> Emily:
>
> Monday morning will be acceptable. I have conference call from 9-10 am CDT, but am open

the rest of the morning.

Written answers? - you'll never get them back.
bill

Dr. William L. Rooney
Professor, Sorghum Breeding and Genetics
Chair, Plant Release Committee
Texas A&M University
College Station, Texas 77843-2474
979 845 2151

-----Original Message-----
From: Emily Hallam [redacted]
Sent: Wednesday, September 23, 2009 3:50 AM
To: 'Bill Rooney'
Subject: RE: request for interview

Dear Bill,

Thank you for your response,

Unfortunately, due to the time difference between London and the US, afternoons are very difficult. My office closes at 5.00 pm GMT (12.00 midday US Central time). Would you be available to talk at all before then, any day this week, or at the beginning of next week?
If its easier, I could email you the interview questions and you could send typed responses?

Kind regards,

Emily Hallam
Editorial Assistant
www.biofuels-news.com
www.tankstoragemag.com
[redacted]

From: Bill Rooney [mailto:wlr@tamu.edu]
Sent: 21 September 2009 18:28
To: 'Emily Hallam'
Subject: RE: request for interview

Emily:

I'll be available Tuesday pm (US Central Time) and Wednesday pm.

regards,

bill

Dr. William L. Rooney
Professor, Sorghum Breeding and Genetics

Chair, Plant Release Committee
Texas A&M University
College Station, Texas 77843-2474
979 845 2151

-----Original Message-----
From: Emily Hallam [redacted]
Sent: Monday, September 21, 2009 3:48 AM
To: wlr@tamu.edu
Subject: request for interview

Dear Mr Rooney,

I'm writing to you from Biofuels International Magazine in London. We are the only international publication dedicated entirely to the biofuels sector.

For the up-and-coming October issue of the magazine I am writing a feature on the use of sweet sorghum as a bioethanol feedstock. I was wondering whether you would be able to put aside some time this week for a brief 20min phone interview to discuss the crop and A&M's development of it. I was assured by Mr Cesar Granda of Terrabon that you were the man to talk to!

I hope to hear back from you soon,

Kind Regards,

Emily Hallam
Editorial Assistant
www.biofuels-news.com
www.tankstoragemag.com
[redacted]

William Rooney, ~~Associate~~ Professor in the Department of Soil & Crop Sciences at ~~of~~ Texas A&M University~~'s Institute for Plant Genomics and Biotechnology~~ is currently developing a sorghum hybrids ~~crop~~ that are to be used as a dedicated bioenergy crop. ~~o overcome the key challenges which sorghum farming presents.~~ The Energy crop company Ceres has invested $5 million in an exclusive, multi-year joint research and commercialisation agreement for both high-biomass sorghum and sweet sorghum. These hybrids ~~plants~~ are not designed to produce grain, but to yield large amounts of ~~vast amounts of~~ biomass.

Research pertaining to the development of sorghum as an energy crop was initiated nearly thirty years ago. ~~The process was started in the 1970s, when rising oil prices led to a flurry of research into heterosis of sorghum,~~ but most ~~initial development~~improvement efforts were shelved when the oil market recovered in the mid to late 1980s.

"~~Whilst S~~sorghum hybrids for grain or forage have been around for a long time, but this is the first time that a hybrid sorghum ~~system~~ has been ~~is being~~ developed specifically for the bio energy consumer market," says Rooney.

The heterotic sorghum substantially out-yields conventional sorghum. Texas A&M researchers are ~~is~~ also working on expanding the range of the crop for earlier planting in cooler and drier conditions~~, especially on so-called marginal or unproductive land~~. According to Cesar Granda of Terrabon, A&M is also working on a low-lignin breed of sorghum, to eliminate the need for pre treatment altogether.

Ceres announced its collaboration with A&M in October 2007, but Rooney's research began almost a decade ago. "Hybris ~~It~~ should be available commercially in the next year, certainly by 2011," says Rooney. If the expectations are met, the new sorghums processed by next-generation conversion technologies could yield a whopping 2000 gallons/acre (18,800 l/ha) of cellulosic ethanol, more than four times the current starch-to-ethanol process

Formatted: Indent: First line: 0"

Comment [MSOffice1]: We do have lower lignin types of sorghum, but we are NOT promoting them for energy production because of significant concerns pertaining to agronomic productivity Cesar may not realize that and is telling you what he would like

Comment [MSOffice2]: I didn't say this The actual amount depends greatly on process, yield and logistics For example, if we have an average yield of 12 dry tons/acre and the conversion is 80 gallons/ton, then the production would be 960 gallons/acre Those 2000 gallons are derived from maximum agronomic yield and maximum conversion potential Some day we might be there, but not yet

From:	Helms, Adam
To:	Gould Mike
Cc:	Bill Rooney; Mullet, John E.; J. Michael Gould; ssearcy@tamu.edu; Patricia Klein; McCutchen, Bill; Avant, Bob; Simpson, Shay; Spurlin, Shayna; Zak, Kendra; Nelson, Michelle; Stelly_David
Subject:	RE: Revised Narrative
Date:	Wednesday, October 14, 2009 10:19:48 AM
Attachments:	DARPA Energy Crops V1.pdf

As requested

Adam Helms
AgriLife Research Corporate Relations
979-255-0752 (mobile)
979-458-2677 (office)

From: Gould Mike [mailto:jmgould@tamu.edu]
Sent: Wednesday, October 14, 2009 8:24 AM
To: Helms, Adam
Cc: Bill Rooney; Mullet, John E.; J. Michael Gould; ssearcy@tamu.edu; Patricia Klein; McCutchen, Bill; Avant, Bob; Simpson, Shay; Spurlin, Shayna; Zak, Kendra; Nelson, Michelle; Stelly_David
Subject: Re: Revised Narrative
Importance: High

I second that request.

Mike
Mike Gould
Center Director

On Oct 14, 2009, at 5:53 AM, Stelly_David wrote:

IS <DARPA Energy Crops V1.mpp> the GANTT chart?

Software required?

Can you output a PDF or image from it and send that?

David

On Oct 13, 2009, at 10:41 PM, Helms, Adam wrote:

Attached is the revised narrative (what Bob sent earlier but with budget corrections), Milestones, Deliverables, Metrics document (w/updated budgets per task), DARPA STO slides formatted for consistency, and the Gantt chart – please have all corrections to me by COB tomorrow.

Thanks,

Adam

Adam Helms
AgriLife Research Corporate Relations
979-255-0752 (mobile)
979-458-2677 (office)

<Milestones_Deliverables_Metrics_Master_Semifinal_v3.doc><DARPA RD Proposal SemiFinal_v3.doc><DARPA_STO slides_081209jm ds wlr ajh.ppt><DARPA Energy Crops V1.mpp>

From: Bill Rooney
To: "Jeff Dahlberg"
Subject: RE: Slide presentation
Date: Tuesday, September 15, 2009 8:15:00 AM
Attachments: Summary_Wet Chem_TAMU.doc

Jeff:

Here's a project update on the funded project. We're waiting on the forage quality data to come back from Dairy One. We've got all the wet chemistry from Ed and we've got the software to generate curves. So, I expect we'll have something done by mid November.

regards,
bill

Dr. William L. Rooney
Professor, Sorghum Breeding and Genetics
Chair, Plant Release Committee
Texas A&M University
College Station, Texas 77843-2474
979 845 2151

-----Original Message-----
From: Jeff Dahlberg [redacted]
Sent: Thursday, September 03, 2009 2:59 PM
To: Bill Rooney
Subject: Slide presentation

Bill:

The USDA is asking for any type of progress report from some of the funded projects. I was wondering if you might have a slide presentation (can be sent as a pdf as well) that we could share with them on the work being done to compare the compositional data with data from animal trials. Does not have to be very elaborate.

Thanks,

Jeff

Dr. Jeff Dahlberg
USCP
4201 N. Interstate 27
Lubbock, TX 79403
Office: 806-687-8727
Cell: 806-438-8501
[redacted]

Summary of the Compositional Analysis at Texas A&M University's Sorghum Breeding Lab

William Rooney and Nilesh Dighe

Texas A&M University's Sorghum Breeding Laboratory has developed a Near Infrared Reflectance Spectroscopy (NIRS) lab for the purpose of building and using NIR calibration models for predicting compositional traits of interest for grain, forage and bioenergy sorghum. In collaboration with the National Renewable Energy Lab (NREL) and the National Sorghum Producers, we are in the final phases of developing a calibration model for bioenergy sorghums. This model is specifically targeted at compositional traits important to energy conversion engineers and it including Glucans, Xylans, Lignin and Solubles.

Measurement of quality for forage sorghum is quite different. Over many years, animal nutritionists and plant scientists have developed rather efficient lab protocols to measure the forage quality of plant biomass. These figures provide relative estimates of protein, digestible fiber, non-digestable fiber using the measurements of ADF, NDF and crude protein (Weiss, 1994). These measurements are appropriate for ruminant animal feeding as they are designed to mimic the digestive processes that occur in the ruminant gut. The sorghum industry has extensive sets of forage quality data on sorghum hybrids used for animal feeding.

The goal of this project is to establish a relationship between traditional forage analysis and NREL composition methods. The specific objectives are 1) to utilize and expand on available wet chemistry analysis to create a robust set of sorghum biomass samples that have analyzed using both wet chemistry methods, 2) create (or use created) NIR calibration curves for both forage and biochemical analysis methods on this data set to estimate composition faster and more economically, 3) establish the relationship between the methods of estimation to accurately use one method to estimate the other, and 4) assess the relative effects of genotype, environment and maturity NIR analysis.

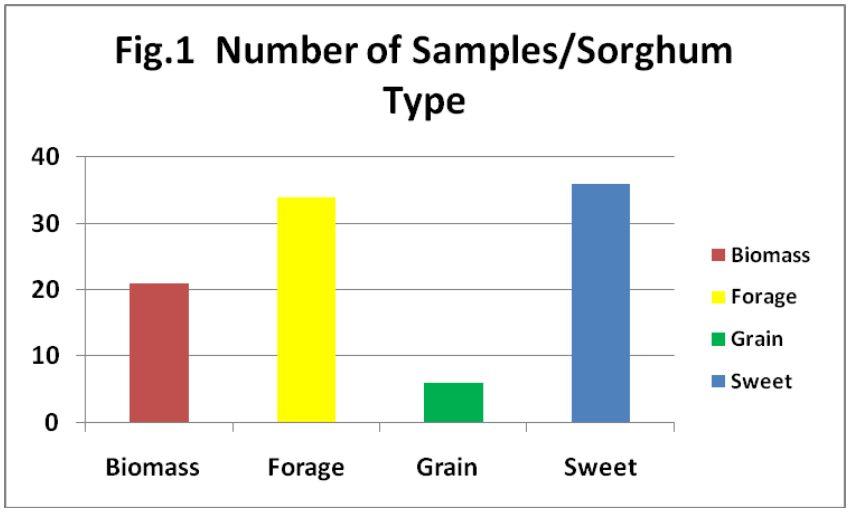
Current Activities

In the process of building a calibration model for bioenergy traits, we have created a core set of samples for which we have spectral and wet chemical data. This set includes 97 samples selected from diverse genetic backgrounds and environments, and are summarized below in Table 1 and Fig. 1. These 97 samples are now being analyzed by Dairy One for full forage quality. The obtained chemical data and the available NIR spectra will be used to develop independent calibration model for forage quality traits.

In addition to developing independent calibration models for both bioenergy and forage quality traits using the same set of samples, the available chemical data for bioenergy and forage quality traits along with the spectral data would allow us to build a NIR model to convert the abundant pre-existing forage quality data into measurable bioenergy traits.

Table.1 Summary of the Total Number of Samples with Wet Chemistry and Spectral Data

Sorghum Type	Number of Samples
Biomass	21
Forage	34
Grain	6
Sweet	36
Grand Total	**97**



From:	Bill Rooney
To:	"Bitzer, Morris J"
Subject:	RE: slide set
Date:	Friday, September 11, 2009 5:15:00 PM
Attachments:	NSSPA - Sorghum Growth and Development Seminar.pdf

---

Morris:

I tried to send this as a powerpoint presentation, but it was too big. So, I made a pdf file and have attached to this e-mail. I hope this will suffice.

As for harvest, we been doing that since July, and it'll continue sporadically until October.

regards,

bill

Dr. William L. Rooney
Professor, Sorghum Breeding and Genetics
Chair, Plant Release Committee
Texas A&M University
College Station, Texas 77843-2474
979 845 2151

> -----Original Message-----
> **From:** Bitzer, Morris J [mailto:mbitzer@uky.edu]
> **Sent:** Friday, September 11, 2009 9:20 AM
> **To:** 'wlr@tamu.edu'
> **Subject:** slide set
>
> Bill: I'll bet you folks are in full harvest mode. The sorghum producers in Texas are mostly done by now. We have started cutting our early planting by
> Transplanting. Sorghum is really tall here this year. What I need from you, is a copy of the talk you made for us about 3 years ago on the
> Growth and Development of the Sorghum Plant. I have a talk, but want to add to it some of the things that you covered. I am going to use that for my talk at the SSEA conference. Morris

Sorghum Growth and Development

W.L. Rooney

Sorghum Breeding and Genetics

Texas A&M University

Many Types of Sorghum

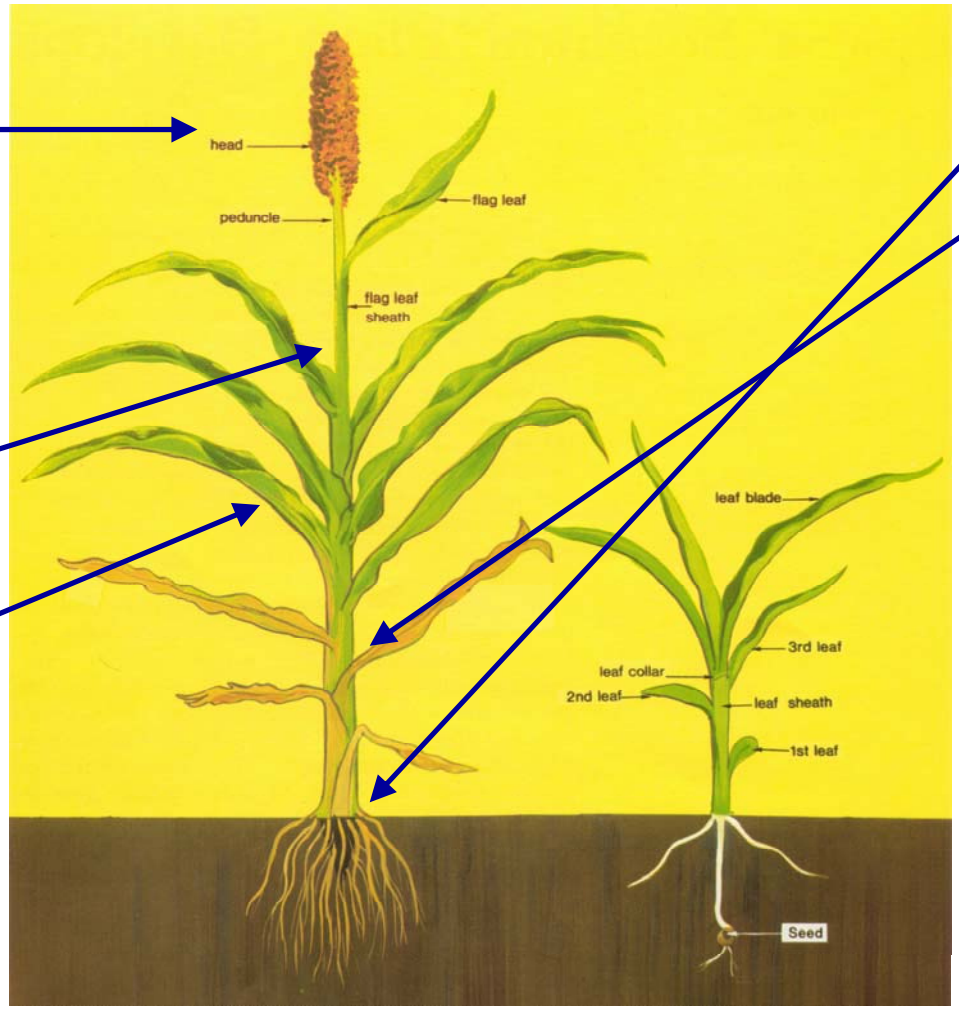
- Grain Sorghum
- Forage Sorghum
  - Hay/Grazing Types
  - Silage Types
  - Photoperiod Sensitive
- Sweet Sorghum
- "BroomCorn" Sorghum
- Highly VARIABLE

Basic Morphology

Panicle
Florets
Grain

Stalk
Peduncle
Node
Internode

Leaf
Leaf Sheath



Tillers
Basal or Crown
Sidebranch or Nodal

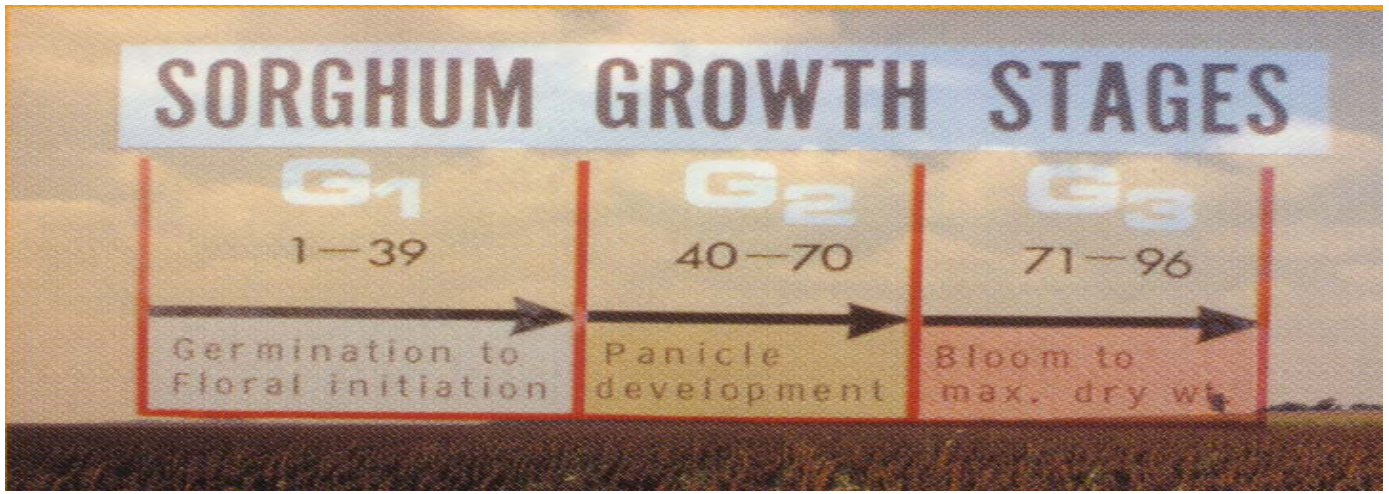
Crown

Root

Growth Pattern is the same for all…

- Sorghum is cereal and member of the grass family (Poaceae)
- Growing point remains close to the ground until the plant transitions to reproductive growth
- Agronomists have developed growth stage scales
  - Vanderlip – Kansas State University
  - Eastin – University of Nebraska

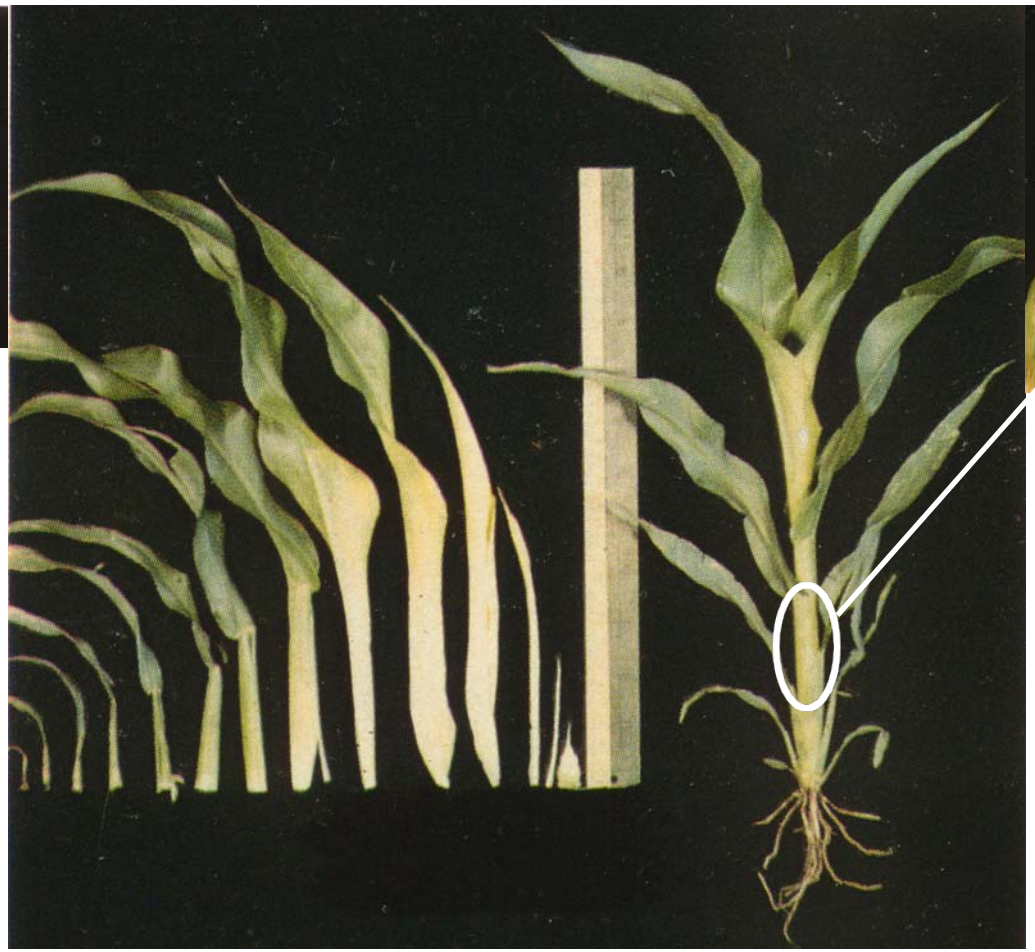
Eastin Scale



- Three Distinct Stages of Growth
- Each easily distinguishable from the other by distinct morphology

Stage 1 : Germination to Floral Initiation

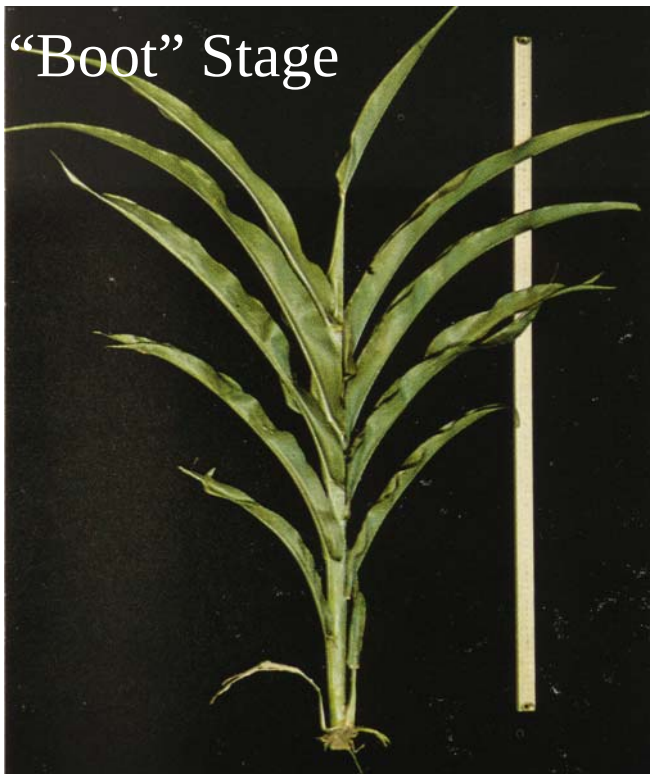
- Emergence
- Seedling Development
- Initial Root Formation and Expansion
- Basal Tillering (if genotype, environment allow)
- Minimal internode extension
- Growing point below/close to ground
- Length of GS1 is contingent on
  - Photoperiod sensitivity reaction
  - Maturity of Line/Hybrid
- GS1 ends with floral differentiation



Duration of GS1 dependent on maturity, environment

Growth Stage 2: Floral Initation to Anthesis

- **Floral Differentiation –**
  - **critical in grain as it defines seed number**
- **Panicle Development**
- **Anthesis (Flowering)**
- **Panicle is Fully Developed**
- **Rapid Internode Growth (maximized height)**
- **Pollination completes GS2**
- **GS2 takes 28-34 days**


“Boot” Stage

Growth Stage 3: Anthesis to Maturity

- **Grain Development**
  - Milk Stage
  - Soft Dough Stage
  - Hard Dough Stage
  - Black Layer – Physiological Maturity
- **GS3 is consistently between 32-28 days**
- **Stalk sugar content maximized**
- **Limited Height Increases in GS3**

Black Layer indicates physiological maturity

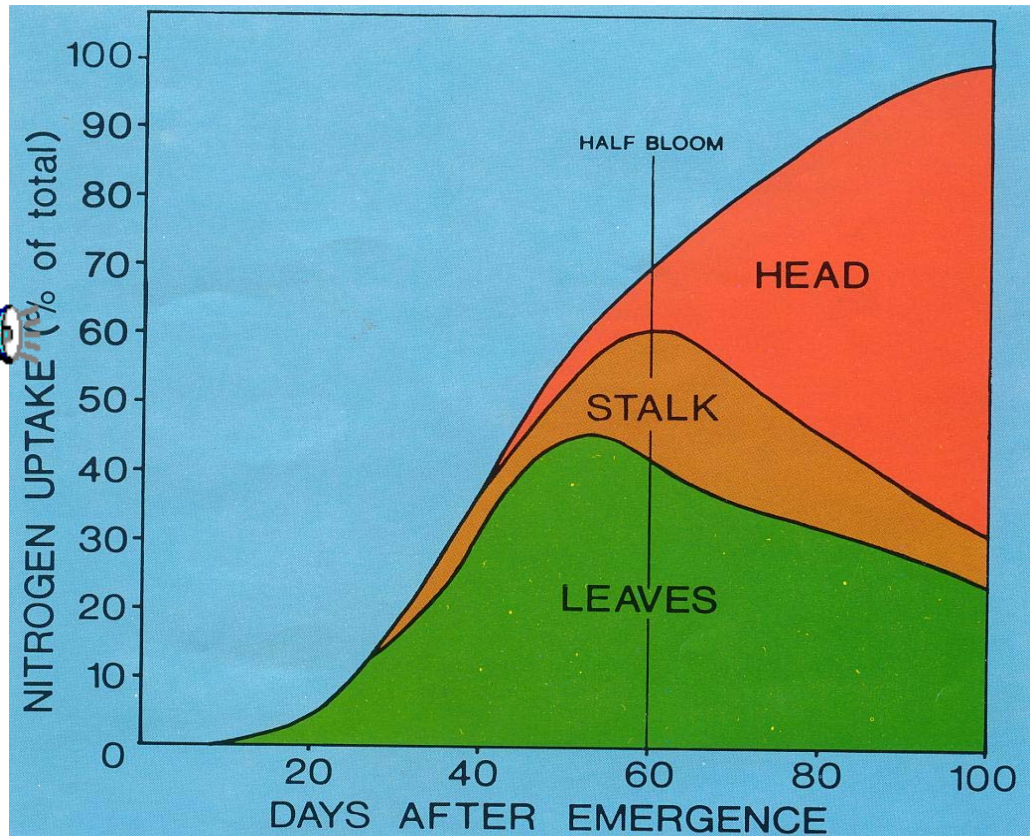
Grain is ~ 35% moisture and drying down.

Management Decisions

- Nutrient Use
- Water Use
- Tillering
- Pests
  - Diseases
  - Insects

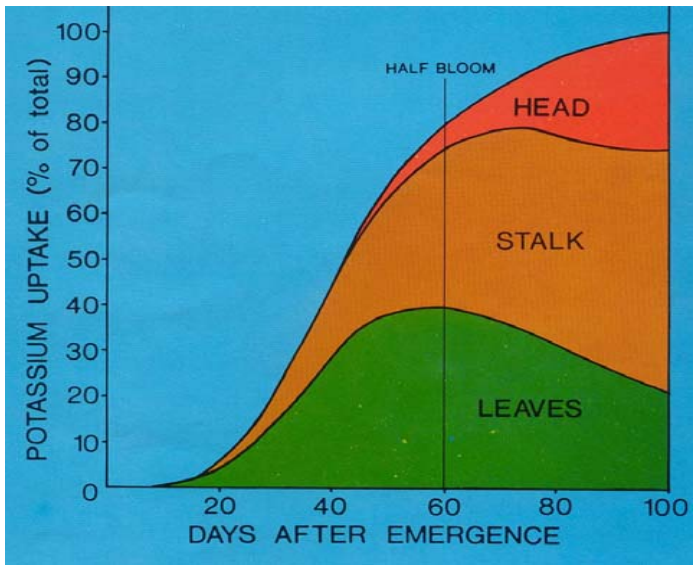
Sorghum Production
Partitioning of N in the Plant

- **At Physiological Maturity**
  - **60 % in Head**
  - **10 % in Stalk**
  - **30 % in Leaves**
- **Ratios are altered in Staygreen hybrids (higher in stalks, because they "staygreen")**

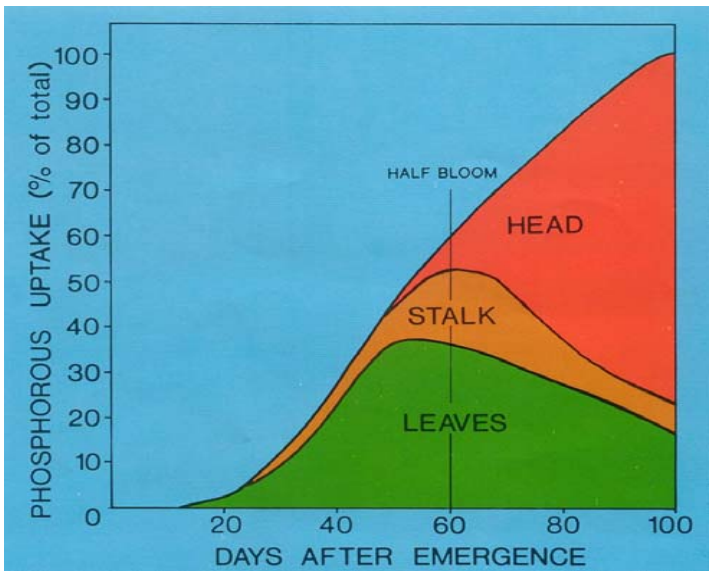


Sorghum Production
Partitioning of P and K in the Plant

- **K at Physiological Maturity**
  - 30 % in Head
  - 50 % in Stalk
  - 20 % in Leaves

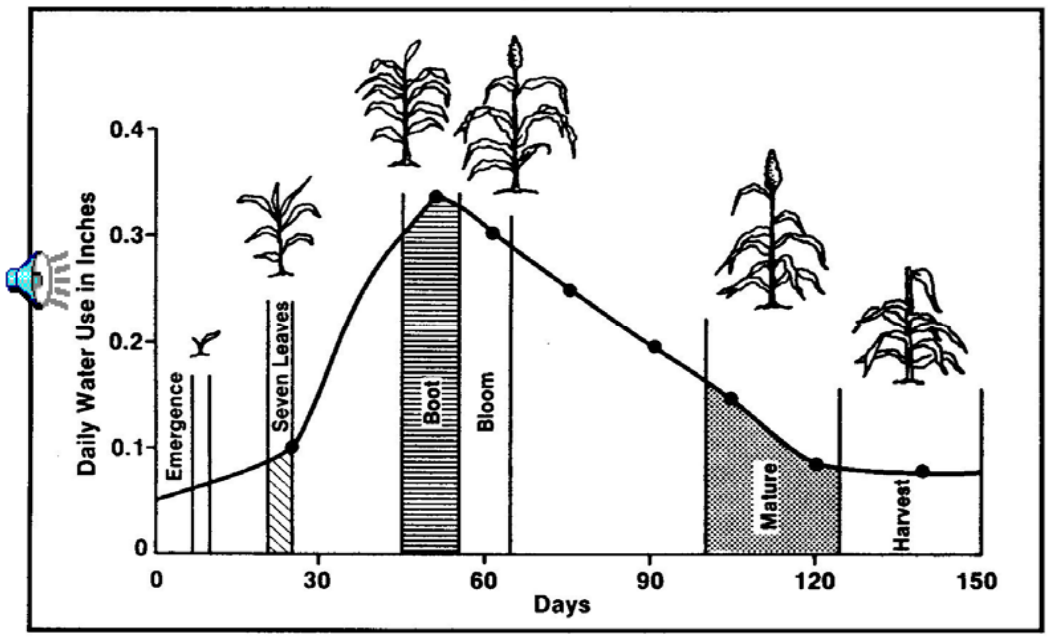


- **P at Physiological Maturity**
  - 30 % in Head
  - 50 % in Stalk
  - 20 % in Leaves



Sorghum Production: Water Requirements

- "will wait" to a limited extent depending on temps
- Water use peaks prior to anthesis
- Crucial Points to avoid water stress
  - GS2/3 – anthesis to maturity
  - GS1/2 – vegetative to reproductive growth



Tillering Types

- **Basal Tillering (from the crown)**
  - **Occurs in GS1**
  - **Influenced by**
    - ✓ Genotype
    - ✓ Environment
      - cool, wet and low population increases tillering
      - Hot, dry and high population decreases tillering
- **Basal Tillering can be a positive or negative trait**

Tillering Types

- **Sidebranch Tillering (from the nodes)**
  - **Occurs in GS3 and post GS3**
  - **Influenced by**
    - ✓ Genotype
    - ✓ Environment
      - Common when wet weather occurs at the end of GS3
      - Management by timely harvest
- **Sidebranch Tillering generally not a desirable trait**

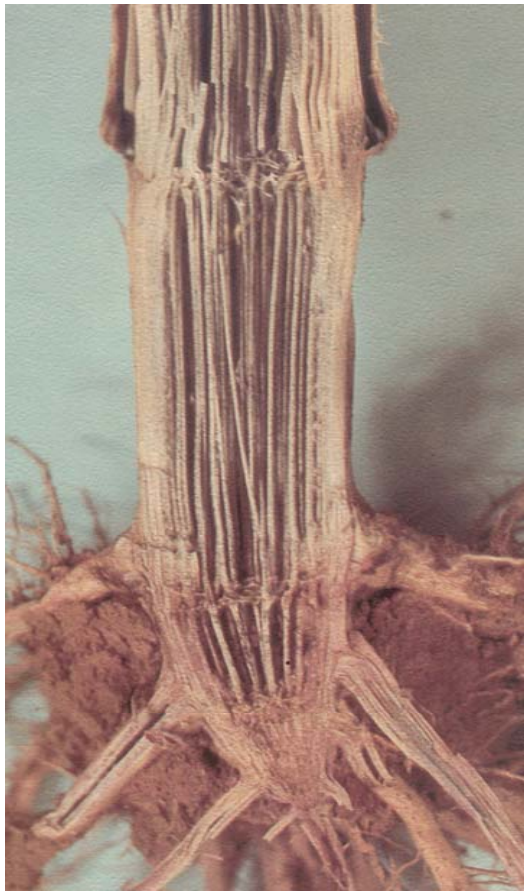
Seedling Disease

- **Seedling Diseases – affect stand establishment and early season growth**
  - **Pythium**
  - **Phytopthora**
- **Controlled using systemic fungicide seed treatment (Apron)**

Sorghum Production : Diseases

- **Stalk Diseases**
  - Lodging
  - Juice Quantity
  - Juice Quality
- **Pathogens**
  - Charcoal Rot
  - Fusarium Stalk Rot
  - Anthracnose Stalk Rot
  - All are controlled using genetic resistance.

Stalk Diseases



Charcoal Rot
Macrophomina phaseolina

Fusarium Stalk Rot
Fusarium thapsinum

Anthracnose Stalk Rot
Colletotrichum graminicola

Foliar Disease

- **Many but only a few of economic importance**
  - ✓ Anthracnose,
  - ✓ Leaf Blight
- **All controlled using genetic resistance**

Panicle Disease

Ergot primarily affects sterile lines, fertilization makes a ovary resistant. It is a concern to seed producers and those who use sterile hybrids.

Ergot is not toxic but it does encourage secondary fungal infections which may be problematic.

Sorghum Production : Insects

- Midge – most damaging sorghum insect
- Parasitic wasp that lays its egg in the ovule at anthesis
- Developing larvae consumes the developing seed.
- Control
  - Early planting (avoidance)
  - Insecticide control
  - No genetic resistance in Sweet Sorghum
- Close monitoring necessary
- Effect on Sweet Sorghum?

Management is the Key

- **Growth Stage affects plant response to stress and it's economic effect**
  - **Stresses at critical time must be managed if possible**
  - **Some stresses are not as critical**
- **The key is to know the difference……**