Tall Fescue Workshop
Tall Fescue Breeding Efforts at UGA

Forage Breeding and Genetics Program
The University of Georgia

Partners:
Grasslanz Technology
Grasslands Innovation Ltd

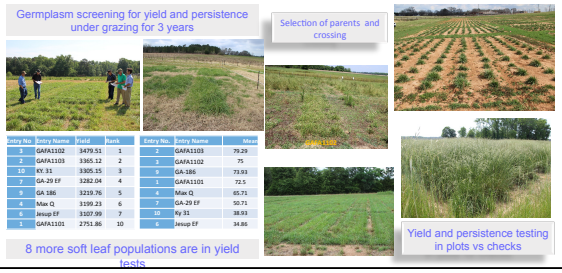
Focus:
- Release and commercialization of cultivars adapted to the Southeast
- Genetic Solutions to major challenges

Cool season grasses | Cool season perennial legumes

Tall fescue cultivars with soft leaf and persistence under grazing

Germplasm screening for yield and persistence under grazing for 3 years

Selection of parents and crossing



Entry No.	Entry Name	Yield	Rank
3	GAFA1102	3479.51	1
2	GAFA1103	3365.12	2
10	KY. 31	3305.15	3
7	GA-29 EF	3282.04	4
9	GA 186	3219.76	5
4	Max Q	3199.23	6
6	Jesup EF	3107.99	7
1	GAFA1101	2751.86	10

Entry No.	Entry Name	Mean
2	GAFA1103	79.29
3	GAFA1102	75
9	GA-186	73.93
1	GAFA1101	72.5
4	Max Q	65.71
7	GA-29 EF	50.71
10	Ky 31	38.93
6	Jesup EF	34.86

8 more soft leaf populations are in yield tests

Yield and persistence testing in plots vs checks

Selection for persistence under grazing

- Experimental populations are evaluated for yield in Watkinsville, Blairsville, and other regional locations

- Persistence under grazing is evaluated at Tifton.

GAFA1402, GAFA1401, GA95101T, MaxQ, 4009

Tall fescue cultivars with soft leaf traits

- It is generally accepted that leaf softness is positively correlated with digestibility and animal preference.

Mediterranean tall fescue cultivars

Three major pools of tall fescue are recognized (Continental, Mediterranean and rhizomatous) that differ in terms of agronomically significant morphological and physiological attributes.

Mediterranean tall fescue cultivars

- Winter active with fast growth from autumn to spring
- Most are summer dormant with a gradient of dormancy
- True dormant types will not grow following summer rains
- Makes a good companion for bermudagrass
- Soft leaves encourage high stock performance
- Tolerant of droughts, heat, and saline conditions

A collection of 1470 accessions of mostly Mediterranean tall fescue for germplasm selection

Dr. Ali Missaoui
Associate Professor and Forage Breeder
Crop & Soil Sciences

GRASS
www.georgiaforages.com

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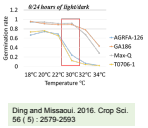
Understanding summer dormancy

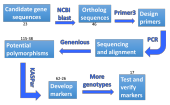
Summer dormancy phenotype
- Score combining regrowth height after clipping and senescence based on Digital Image Analysis of 218 tall fescue accessions

Regrowth (cm)	Regrowth score	Percentage of dead plant	Senescence score
1-2.5	1	91-100	1
2.5-5	2	81-90	2
5-7.5	3	71-80	3
7.5-10	4	61-70	4
10-12.5	5	51-60	5
12.5-15	6	41-50	6
15-17.5	7	31-40	7
17.5-20	8	21-30	8
20-22.5	9	11-20	9
>22.5	10	0-10	10



Ding and Missaoui 2016. Crop Sci. 56 (5) : 2579-2593

Candidate genes (23)
- Flowering and circadian clock (6)
- Winter dormancy and seed dormancy (14)
- Heat shock proteins (1)
- Drought inducible 22 kD protein (1)
- Biotic and abiotic stress responses (1)



Marker assisted selection for summer dormancy

KASP SNP markers	SNP alleles (D/ND)[1]	No. of heterozygous	Correlation with SDRS[2]	R2 with SDRS[2]	R² with GRL score[4]
CO1-TF-15981	C/A	2	0.27	0.12*	0.01
CO1-TF-1576	T/A	4	0.27	0.11*	0.00
TFNEW-TF-15219-3	A/G	1	0.33*	0.10*	0.01
CO4-TF-15911	C/T	0	0.33*	0.11*	0.00
CO1-TF-15180	C/G	1	0.37*	0.13*	0.06
VER-MADS-TF-1586o	G/T	8	0.16	0.00	0.20*
HEAT1-TF-15130	C/A	0	0.16	0.01	0.15*
ARF1-TF-15383	T/C	4	0.04	0.00	0.14*
ARF6-TF-1556s	G/A	16	0.16	0.02	0.16*

- Confirmed the major role of photoperiod and temperature in the initiation and maintenance of summer dormancy
- Tall fescue is most likely using determinacy as a mechanism to initiate summer dormancy

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Improving white clover as companion to talll fescue

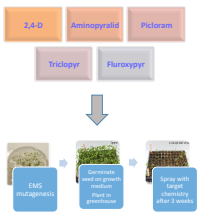
Non GM White clover cultivars with Auxin Herbicide Resistance

Partner: Grasslanz Technology

One of the obstacles to the establishment of white clover in grass mixtures or following a grass pasture is the application of herbicides that control broad leaf weeds

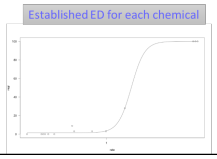
Herbicides frequently used in the Southeastern US are WeedMaster (2,4-D + dicamba), Grazon (picloram + 2,4-D), Milestone (aminopyralid), PastureGard (triclopyr + fluroxypyr), Surmount (picloram + fluroxypyr), and Grazon Next (2,4-D + aminopyralid)

Induced mutagenesis offer a valuable role in generating novel phenotypes of commercial importance in crop species including herbicide tolerance.



Establishing Effective rates for selection of resistant white clover genotypes

Established ED for each chemical



Regrowth
ED10 = 1.22 ± 0.106 lb/A
ED50 = 1.61 ± 0.49 lb/A
ED90 = 2.13 ± 0.48 lb/A

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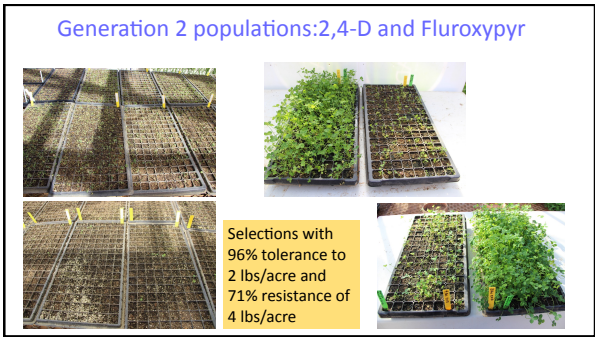

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