

Lessons Learned in 32 Years of Forage Breeding in Florida

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I am generally not one to wax philosophical, but when Ray Smith called and asked me to speak to the Southern Forage Breeders Workgroup, on “any topic you wish”, this seemed to be a good opportunity to share some “wisdom”. I arrived at the University of Florida in April of 1975, thus I have just passed my 32nd anniversary, and maybe that qualifies me as a senior statesman. The “Lessons” I share below are probably not unique, and others could probably develop their own set of “Lessons”, but for now these are mine, with illustrated examples from my research experiences.

Lesson 1. You are not nearly as smart as you thought you were coming out of grad school!

Believing that I had excellent graduate training at the University of Kentucky, I arrived at the University of Florida, only to be told that my first breeding project was to be improvement of the tropical grass *Hemarthria altissima* (Poir.) Stapf & C. E. Hubb. In all my 27 years of life to this point including 8 years of higher education, I had never even heard of this plant, and what was worse, the locals could not even agree on a common name to use for it (choices included alta grass, hemgrass, hemarthria, mafia grass, and limpograss - the one finally agreed on). Nevertheless we did have a diverse collection of germplasm that showed a large amount of variability (another lesson one should learn very early, but it did not make my top ten list). Thus we started a program of germplasm evaluation (no breeding involved at this point). It was learning about tropical grasses by doing!

At about this same time I was introduced to plant parasitic nematodes. I believe in my undergraduate plant pathology class we may have spent one day on this topic, but here at Florida they had a half a department devoted to these critters (Entomology and Nematology Department), and they seemed to feed on most every plant one tried to grow in Florida. So I soon found a cooperator in Nematology (see Lesson 3) and we screened the limpograss collection for response to sting nematode (*Belonolaimus longicaudatus*) (Quesenberry and Dunn, 1981). From the relationship with this cooperator, Dr. R. A. (Bob) Dunn, I also learned about root-knot nematodes (*Meloidogyne* spp.) (RKN) (another nematode I knew nothing about, but that was a major pest on many plant species in Florida) and we soon began a ten year program of recurrent selection for RKN resistance in red clover that ultimately led to the release of the cultivars ‘Cherokee’ and ‘Southern Belle’ (Quesenberry et al., 1993, Quesenberry et al., 2005). Now many years later, I’ve come to realize that there is much more that I don’t know and one’s goal must be to be a life-long learner!

Lesson 2. Be sure you have well defined objectives that are “easily measured”.

This is illustrated with the release of ‘Floralta’ limpograss. There was a simple stated objective - We need a limpograss that has improved persistence under grazing. With a group of

selections that has passed through Phase 2 of our selection program (Quesenberry et al., 1977), Dr W. R. (Bill) Ocumpaugh (Lesson 3) and I initiated a mob grazing experiment and within two years had identified the selection that was ultimately released as Floralta (it yielded well and persisted whereas several others were mostly dead = easily measured) (Quesenberry et al., 1984, 1987). More will be said about this cultivar under Lesson 5. Likewise, RKN response is relatively easy to measure (you just examine the roots and rate of galling and egg mass production = easily measured). Dr. D. D. (David) Baltensperger (see Lesson 3) and I worked out a technique for screening large number of plants for response to various RKN species (Quesenberry, et al., 1986). Over the years this technique generated many publications and has been used in the development of at least four different cultivars (Baltensperger et al., 1985; Call et al., 1996, 1997; Kouame et al., 1995, 1997, 1998; Quesenberry and Dunn, 1987; Quesenberry et al., 1989, 1993, 1997, 2005; Soffes et al., 1983; Zimmet et al., 1986; Taylor et al., 1986). Someone once said, "Give me a screen with the 'right size/shape hole' and I can select for almost anything." Identifying important (yield and production limiting) traits that can be screened for across large numbers of individuals will always be critical for successful forage breeders.

Lesson 3. Good friends, cooperators, and technical support are important.

Part of what needs to be said here has already been mentioned above in Lessons 1 and 2, but I would be neglect not to mention a host of other folks. I've certainly learned that successful forage plant breeders need many cooperators. What follows is an incomplete list of the many that have assisted in my program over the past 32 years. These include forage management agronomists (Leonard Dunavin, Rob Kalmbacher, Al Kretschmer, Paul Mislevy, Bill Ocumpaugh, Gordon Prine, Charles Ruelke, Lynn Sollenberger, Bob Stanley, and Jeff Steiner), fellow breeders (David Baltensperger, Joe Bouton, Byron Burson, Glen Burton, Wayne Hanna, Jorge Mosjidis, Gary Peterson, Dick Smith, G. Ray Smith, Norman Taylor, and David Wofford), international colleagues (Bruce Cook, Mark Hutton, John Miles, Liana Jank, Daniel Real, Warren Williams, and many others), even some administrators (Jerry Bennett, Charles Dean, Joe Joyce, and Coleman Ward), and I'm sure I have left out many others. One of the most important elements to long term success in forage breeding is strong and long tenured technical support. I have been very fortunate to have five individuals in my 32 year career at Florida without whom much of what has been accomplished would not have been possible. Deep gratitude is expressed to Dick Booth, Judy Dampier, Renee Kratka, David Moon, and Loan Ngo).

Lesson 4. Clovers can be important in the Deep South, but they have their problems.

This lesson perhaps is best illustrated with Cherokee and Southern Belle red clover (Quesenberry and Blount, 2006; Quesenberry et al., 1993, 2005). Under optimal conditions of rainfall we have measured yields that rival those of the upper Midwest and producers have successfully made excellent red clover hay in Alachua County that brings top dollar at local sales outlets. Some of these producers think we have worked magic on red clover. Improving RKN resistance and selection for early spring production (non-dormancy) has had major impact on the adaptation of red clover for the southeastern USA. Similar success has been observed with Osceola white clover released from the UF/IFAS Agronomy department (Baltensperger et al., 1984). Conversely, even when doing everything that I thought I knew to do right (see Lesson 1) I have had near complete failures of red clover and white clover small plots and producers have also suffered similar problems. The 2006-07 season in north Florida was one of those "bad" years, and you will not be seeing clover plots on the tour at Marianna this year. Even with

extensive nematology, pathology, agronomic, and other input we do not have a consensus on the cause(s) for some of these failures.

Lesson 5. Your most successful cultivar likely will not be the one you thought.

When Floralta limpograss was released (Quesenberry et al., 1984), I do not think any of the developers expected it to become the “success” that it is today. Although several years were required for it to “take-off”, we now estimate that there may be as much as 100,000 hectares of Floralta in central and south Florida. Several large ranches developed methods for mechanizing planting which greatly improved its use. This cultivar has certainly found a niche for fall-winter forage production for the beef cow-calf producers. Conversely, Cherokee red clover, has probably never been planted on more than 10,000 acres in any one year, although over the years it has made substantial contributions for those producers that have learned where it fits into their production system. This lesson is likely a corollary to Lesson 1 - not being as smart as we thought we were.

Lesson 6. Grant \$\$ may not result in cultivar releases (but they may get you promoted and tenured).

Shortly after I arrived at Florida, nitrogen fixation by tropical grasses associated with *Azospirillum lipoferum* was a major topic of interest (Smith et al., 1976) with federal funding agencies (USAID), and a team of Florida investigators including myself obtained significant grant dollars to support this research. This collateral funding enhanced some of my early breeding projects, but was not for cultivar development. Later funding for tropical legume evaluation was obtained from USDA-CSREES special grants for Tropical and Sub-Tropical Agricultural Research (TSTAR), but again no cultivars have resulted from these projects (although a rhizoma perennial peanut release is pending). Nevertheless, a resume showing multiple millions of dollars in grant support over a career will be important for tenure, promotion, and special pay increases! My lesson from these experiences is that grants may detract from overall plant breeding objectives, but they are critical to succeed in an academic environment.

I would be remiss not to voice a concern that long term plant breeding programs will not be sustained by short term grant funding. Current “hot-topic” issues funding often draws funding from sustained long term programs that ultimately deliver broadly-adapted cultivars. Quality science should always triumph in funding decisions, but certainly there is a need for breeders to be attuned to creative opportunities for funding programs. Royalties from previous successful releases may offset some of the lows in sustained funding.

Lesson 7. Marketing may be more important than breeding.

A primary illustration of this lesson is ‘Osceola’ white clover (Baltensperger, et al., 1984). The initial rights to production and marketing of this cultivar were assigned to a company that had limited experience in clovers (and who ultimately got completely out of the forage breeding business). Little seed was produced or sold. A second company had one individual that aggressively marketed this cultivar, and over the past 15 years it is estimated to have been planted on over 2.5 million acres in the USA. Other cultivars that had similar good agronomic attributes and broad environmental adaptation have not enjoyed such success, often due to poor or limited marketing efforts. A good production, distribution, and marketing company is equally as important as a superior cultivar.

Lesson 8. Be nice to your graduate students, they may be your next cooperator or boss.

In the past 32 years at Florida I have chaired or co-chaired almost 30 graduate committees, and have served on well over 75 committees. The great majority of these have been excellent high quality students. Many have enjoyed great success in their own programs after completing their student tenure at Florida and some have passed by their former mentor. One of these is Dr. Chris Deren, who after a number of years as a successful sugarcane and rice breeder at the UF/IFAS Everglades Research & Education Center at Belle Glade, Florida, is currently serving as the Director of the University of Arkansas, Rice Research and Extension Center at Stuttgart. Another is Dr. Neysa Call, who after completing a MS with me at Florida moved to North Carolina, for a Ph.D. and is currently employed as a Legislative Policy Analyst in the Office of Legislative and Public Affairs of the US National Science Foundation in Washington, DC. One who has become a valued cooperator is Dr. Ann Blount who after a 10 year career as a research associate with the UF/IFAS North Florida REC in Small Grains Breeding Program, now is pushing me along with a tetraploid bahiagrass breeding program and has chaired two student committees where I have served as the on-campus co-chair. Through some changes in faculty, I was fortunate to be asked to serve as co-chair of the Ph.D. program for Dr. Lynn Sollenberger in forage management. After completing his degree at UF we were fortunate to hire him on the faculty and about a year ago he assumed the role of Associate Chair of Agronomy - my associate-boss. As most of you know he is recognized around the world for his pasture management research program.

One of the great strengths of the Land Grant College System is the interaction of teaching, research, and extension. I feel that first and foremost I am a teacher - even my children will agree with that! The ability to incorporate real world examples from breeding experiences into classroom teaching has certainly been a strength of my career. Numerous students have shown those “ah-ha moments” in the classroom when real photos and data have illustrated a textbook concept. Working with students has been and continues to be a highlight of my breeding career.

Lesson 9. What goes around may come around so don't forget those lessons learned.

After the release of Floralta limpograss in 1984, I made the decision that limpograss did not merit additional breeding effort (this was before we saw how wide spread it would be planted). In a Florida Cattleman's Research Council meeting a few years ago the interest in additional limpograss cultivars was put forth as a priority. In 2005-06 we initiated a small program of producing hybrids with the objective of improving the nutritive value (IVOMD) while maintaining persistence. Currently 51 hybrids are under Phase 2 evaluation at the UF/IFAS Range Cattle REC at Ona, at the Agronomy Forage Research Unit near Gainesville and at the North Florida REC at Marianna. Thus, I am having to remember all I learned and mostly forgot about how limpograss grows and needs to be managed in an evaluation program. Breeding vegetatively propagated species is a different game.

Lesson 10. Don't forget your family and friends and stay humble.

Most of you who know me well, recognize that my family (especially Joyce) usually travels with me to most scientific meetings. Likewise, those in Florida know that she and the children have been hauled around the state to look at forages from Pensacola to Immoklee and beyond. I firmly believe that becoming too focused on one's research is “bad for your health”

and for the health of your family. We have taken two sabbatical leaves while at Florida (and should have taken more). The family struggled and prospered through both of them, but looking back would not take anything for the experiences. Good and life-long friendships were made at both locations. We have attended every International Grassland Congress since 1981 (Lexington, KY, USA; Kyoto, Japan; Nice, France; Palmerston North, New Zealand and Rockhampton, Australia; Winnipeg and Saskatoon, Canada; Sao Pedro, Sao Paulo, Brazil; and Dublin, Ireland and Aberystwyth, Wales), and virtually all national ASA/CSSA/SSSA meetings since 1975, as well as numerous *Trifolium* conferences and regional project meetings. Such trips make life worthwhile, strengthens families and nurtures friendships.

In the waning years of my breeding career I have become more active in CSSA and will begin a three year term as President-elect/ President/ Past-president in November 2007. I am hopeful that some of the lessons learned above will be useful in this new leadership role. I'm sure my family and friends will provide encouragement and support and also see that I remember Lesson 1! I trust that you may find one or more of these instructive in your forage breeding endeavors.

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