An evaluation of the Triticeae Coordinated Agricultural Project (TCAP)

Results from the 2012 MSI PI survey

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Table of contents

List of tables and figures

Introduction

The Triticeae Coordinated Agricultural Project (TCAP), funded by the United States Department of Agriculture (USDA), is an effort to improve the quality of wheat and barley breeding and increase the number of plant breeders, especially from racially and ethnically diverse backgrounds. TCAP's educational component consists of providing education and research opportunities for graduate students in plant breeding programs and partnering with faculty from minority serving institutions (MSIs) to promote the plant breeding field.

An evaluation with multiple components is being conducted to assess the progress of TCAP. One of the evaluation components is a yearly survey to assess the perceptions of plant breeding education, perceptions of TCAP programming, and collaborative relationships and networks over time of principal investigators from minority serving institution partners (MSI PIs). This report provides a summary of survey results from the second year of programming.

Methods

The evaluation team worked collaboratively with members of the TCAP educational committee to make revisions to the baseline survey. The 2012 TCAP MSI PI Survey was administered online to in early June. The survey assessed perceptions of MSI and TCAP PI relationships, barriers to recruiting underrepresented students into plant breeding, plant breeding education for graduate students, the TCAP educational programming, and collaborative networks with other students, faculty, and researchers within and outside of the TCAP. Results for items with the highest and lowest ratings are highlighted in the "Key findings" section, while results are summarized more generally in the "Issues to consider" section.

Respondents' demographics

There are a total of eight MSI PIs within TCAP, including four males and four females (Table 1). Six MSI PIs reported being between 40 to 59 years old (Table 2). None of the eight MSI PIs reported being of Hispanic or Latino origin (Table 3). Half of the MSI PIs identified as Asian (4 of 8), while the other half of the MSI PIs (4 of 8) identified as Black or African American (Table 4). Of these eight PIs, six PIs completed this year's survey. Demographics for these six PIs are not reported to ensure the confidentiality of their responses.

Key findings

Summarized by Mao Thao, BS, BA

Results should be interpreted with caution as the sample size is very small. Additionally, there were many items with missing data. It is unclear why respondents skipped some items, but it appears that respondents did go through the entire survey. The following are key findings from the MSI PI survey. Percentages are not reported due to the small number of MSI PIs.

- On a 5-point rating scale, with one being "not important at all" and 5 being "extremely important", 5/5 MSI PIs rated four items as "extremely important" educational components of TCAP including research, relationship development with faculty from TCAP institutions, increasing the number of plant breeders from culturally diverse backgrounds, and understanding challenges. No items were rated lower than a rating of five (Table 5).
- MSI PIs generally felt that the most important things TCAP can accomplish was attracting and increasing more students to pursue plant breeding. A couple respondents also felt it was important to get students involved with research (Table 6).
- MSI PIs felt that the lack of interest, knowledge, and exposure of plant breeding were key barriers to increasing the number of underrepresented groups in plant breeding. Funding was also mentioned as a barrier (Table 7).
- All six MSI PIs felt their relationships with TCAP institutions were "very strong" (Table 8). Half of the MSI PIs (3/6) reported that they collaborate with TCAP faculty "a lot" (Table 9).
- Funding was cited as a key barrier to collaborative research with faculty from TCAP institutions by four of the six MSI PIs. Other cited barriers include difference in research interests and time and distance constraints (Table 10).
- While MSI PIs may not have graduate students, the survey asked them about their opinions on educating students in graduate plant breeding programs.
    - Overall, all six MSI PIs felt the 10 knowledge areas listed were at least "moderately" valuable, with the exception of teaching strategies that received a rating of "somewhat" valuable by one respondent. Plant breeding strategies was the one item that received a "very" valuable rating by all respondents (Table 11). A couple MSI PIs also cited grant writing techniques and the integration of breeding in biotechnology as other valuable knowledge areas for plant breeding graduate students (Table 12). Half of the MSI PIs (n = 3) ranked plant breeding strategies as the most valuable knowledge area for a graduate student, while the other half of the MSI PIs (n = 3) ranked data management as the most valuable knowledge area (Table 13).
    - Of the 19 plant breeding skills listed, all six MSI PIs felt designing experiments and observing and interpreting results were the "very" valuable skills for graduate students in plant breeding. All other items received ratings of at least "moderately" valuable (Table 14). Designing experiments was ranked as the top most valuable skill for a graduate student by two of six MSI PIs, as well as defining and solving problems that was also ranked as the most valuable skill by two other MSI PIs (Table 16).
    - One-on-one mentoring and exposure to diverse research methods and tools were rated as "extremely important" educational components by all six MSI PIs out of 13 listed

processes. All other educational components did not receive lower ratings than "extremely important;" however, not all of the MSI PIs responded to each item (Table 17).

- MSI PIs most frequently interacted with their advisee/s, other students at their institution, and other researchers at their institution (Table 18). Interactions with researchers at their institutions typically focused on collaborations, while interactions with their advisee and other students revolved around various topics, including collaborations, interpreting research results, class assignments/classes in general, trouble shooting research, and mentoring (Table 19).

Issues to consider

The following are some issues for consideration based on the survey results:

- As many MSI PIs skipped some items, it is difficult to interpret perceptions. For future surveys, it should be considered whether it is relevant to ask about the value of plant breeding knowledge and skills for graduate students, especially if some MSI PIs do not have graduate students.
- MSI PIs seem to highly value research, as well as their relationships and collaborations with TCAP institutions. The TCAP should continue to find ways to offer collaborative research and networking opportunities, as well as funding for MSI and TCAP faculty to continue to work together.
- MSI PIs also highly value increasing the number of plant breeders of diverse backgrounds; however, many cited that lack of knowledge about plant breeding was a barrier. The TCAP should consider and develop strategies for all PIs to work together in promoting and increasing awareness of the opportunities plant breeding has to offer among undergraduate students.
- Few MSI PIs appear to frequently interact with students from TCAP institutions. The TCAP should consider whether this is a priority of the project and develop strategies for providing opportunities for MSI PIs and TCAP students to interact and network.

Table 1: MSI PIs' gender.

What is your sex?	n/N
Male	4/8
Female	4/8

[a] Percentages are not reported given the low number of respondents (N's).

Table 2: MSI PIs' age.

What is your age?	n/N
18 to 29 years old	—
30 to 39 years old	—
40 to 49 years old	3
50 to 59 years old	3
60 to 69 years old	—
70 years old or older	—

[a] Percentages are not reported given the low number of respondents (N's).

Table 3: MSI PIs' ethnicity.

Are you of Spanish, Hispanic, or Latino origin?	n/N
Yes	—
No	8

[a] Percentages are not reported given the low number of respondents (N's).

Table 4: MSI PIs' race.

Please specify your race:	n/N
American Indian or Alaskan Native	—
Asian	4
Black or African American	4
Native Hawaiian or Pacific Islander	—
White	—
Mixed race	—

[a] Percentages are not reported given the low number of respondents (N's).

Table 5: Respondents' perceptions of the importance of TCAP educational components.

How important are the following components of the education portion of TCAP?	Not important at all 1	2	3	4	Extremely Important 5
Research	—	—	—	—	5/5
Relationship development with faculty from TCAP institutions	—	—	—	—	5/5
Increasing the number of plant breeders from culturally diverse backgrounds	—	—	—	—	5/5
Understanding challenges to recruiting and retaining underrepresented groups in pant breeding graduate programs	—	—	—	—	5/5
Teaching/learning tools	—	—	—	—	4/4
Interaction with plant breeders at other institutions or in the industry	—	—	—	—	4/4
TCAP seminar series	—	—	—	—	4/4
Faculty mentoring of graduate students	—	—	—	—	3/3
Inquiry-based learning approaches	—	—	—	—	3/3
Collaboration between MSI students and TCAP students	—	—	—	—	3/3
Recruiting more American-born, underrepresented groups to plant breeding programs	—	—	—	—	3/3
Online course (Plant Breeders Training Network (PBTN))	—	—	—	—	2/2
Group interactions at Plant and Animal Genome Meeting (PAG)	—	—	—	—	2/2
Participation in National Association of Plant Breeders (NAPB)	—	—	—	—	2/2
Skills workshops (Canopy spectral reflectance (CSR), Triticeae data base (T3) training, and others)	—	—	—	—	1/1
Graduate student mentoring of undergraduates	—	—	—	—	1/1
International travel/workshop (International Maize and Wheat Improvement Center (CYMMIT))	—	—	—	—	1/1
Plant breeding educational film	—	—	—	—	1/1

Table 6: The top two areas respondents identified as the most important things TCAP can accomplish.

What are the two most important things you see the education component of TCAP accomplishing?	
First response	**Second response**
Attract more students to plant breeding	Expose plant breeding as a viable (if not better) career option
Awareness	Involving MSI
Expose more MSI Students to Plant Breeding	Bring Plant Breeding in the forefront of the cyber era
New Research Methods	Learning/Education
Recruiting more American-born, underrepresented groups to plant breeding programs	Relationship development with faculty from TCAP institutions
Student involves with research	Collaboration among programs

Table 7: The top two barriers to increasing the number of underrepresented groups in the plant breeding field.

What are the top two barriers you see to increasing the numbers of underrepresented groups in the plant breeding field?	
First response	**Second response**
Funding	What student want
Historical issues	Lack of Knowledge about agriculture
Ignorance and plant breeding not being considered a viable career option	Lack of exposure to the field
Increasing MSI participation	Increasing MSI funding
Most students preferred to work on medical field after graduate since the salary is higher and more respect by public is received	Some HBCU school has no plant breeding major
Need more scholarship	Awareness

Table 8: Respondents' perceptions of the strength of their relationship with TCAP institutions.

	Not strong at all 1	**2**	**3**	**4**	**Very strong 5**
How strong do you feel your relationships are with TCAP institutions?	—	—	—	—	6/6

Table 9: Respondents' collaboration with TCAP PIs.

	Not at all	**Somewhat**	**A lot**
How often do you collaborate, i.e. work on a research project, with faculty from TCAP institutions?	1/6	2/6	3/6

Table 10: The top two barriers to collaborating on research projects with TCAP.

What do you believe are the two most important barriers to collaborating on research faculty from TCAP institutions?	
First response	**Second response**
Communication	Funding
Faculty at Liberal art school have heavy teaching load and don't have enough time to concentrate on research.	Faculty at Liberal art school especial small colleges don't have enough facility to support faculty research on plant breeding.
Funding	Finding an intersect of research interests/priorities
Funding	Funding
Funding	Human Resources
Proximity	Time

Table 11: Respondents' perceptions of the value of plant breeding knowledge areas.

How valuable are the following knowledge areas for a graduating MS or PhD student in plant breeding?	Not at all 1	Somewhat 2	Moderately 3	Very 4
Plant breeding strategies (e.g. traditional, molecular, physiological)	—	—	—	6/6
Data management (collection, analysis, database)	—	—	1/6	5/6
Causes of and resistance to biotic stress	—	—	1/6	5/6
Genetics (mendelian, quantitative, population and molecular)	—	—	1/6	5/6
Selection theory and techniques	—	—	1/6	5/6
Factors in crop plants that impact productivity	—	—	1/6	5/6
Methods for breeding in selfing and outcrossing systems	—	—	2/6	4/6
Experimental design	—	—	1/5	4/5
Causes of and resistance to abiotic stress	—	—	3/6	3/6
Teaching strategies (Inquiry-based learning approaches)	—	1/6	2/6	3/6

Table 12: Other valuable plant breeding knowledge areas.

Are there any other knowledge area that you think are valuable for graduating MS or PhD students in plant breeding?
Grant writing techniques
No
Yes, especially the integration of breeding in biotechnology

Table 13: Respondents' ranking of the most valuable plant breeding knowledge areas.

What are the three most valuable knowledge areas for a graduating MS or PhD student in plant breeding?	#1 Rank	#2 Rank	#3 Rank
Plant breeding strategies (e.g. traditional, molecular, physiological)	3/6	1/6	—
Experimental design	3/6	—	—
Data management (collection, analysis, database)	—	2/6	1/6
Genetics (mendelian, quantitative, population and molecular)	—	1/6	3/6
Causes of and resistance to biotic stress	—	1/6	—
Factors in crop plants that impact productivity	—	1/6	—
Selection theory and techniques	—	—	1/6
Teaching strategies (Inquiry-based learning approaches)	—	—	1/6
Causes of and resistance to abiotic stress	—	—	—
Methods for breeding in selfing and outcrossing systems	—	—	—
Other	—	—	—

Table 14: Respondents' perceptions of the value of plant breeding skills.

How valuable are the following skills for a graduating MS or PhD student in plant breeding?	Not at all 1	Somewhat 2	Moderately 3	Very 4
Design experiments	—	—	—	6/6
Observe and interpret results	—	—	—	6/6
Work cooperatively	—	—	1/6	5/6
Define and solve problems	—	—	1/6	5/6
Communicate your scientific ideas	—	—	1/6	5/6
Statistical analysis	—	—	1/6	5/6
Choose parents and make crosses	—	—	1/6	5/6
Manage data	—	—	2/6	4/6
Identify new alleles to use for improvement	—	—	2/6	4/6
Make genome wide selections	—	—	2/6	4/6
Mentoring skills	—	—	2/6	4/6
Make phenotypic selections	—	—	3/6	3/6
Networking skills	—	—	3/6	3/6
Molecular techniques	—	—	4/6	2/6
Make marker assisted selections	—	—	4/6	2/6
Resource management skills	—	—	4/6	2/6
Consider alternative hypotheses	—	—	5/6	1/6
Utilize single nucleotide polymorphisms (SNPs) or genotype by sequencing (GBS)	—	—	5/6	1/6
Leadership skills	—	—	5/6	1/6

Table 15: Other valuable plant breeding skills.

Are there any other plant breeding skills that you feel are valuable for graduating MS or PhD students in plant breeding?
Yes, use DNA array and protein array to identify new genes

Table 16: Respondents' ranking of the most valuable plant breeding skills.

What are the three most valuable skills for a graduating MS or PhD student in plant breeding?	#1 Rank	#2 Rank	#3 Rank
Design experiments	2/6	—	1/6
Define and solve problems	2/6	—	—
Statistical analysis	1/6	—	1/6
Work cooperatively	1/6	—	—
Observe and interpret results	—	1/6	1/6
Make marker assisted selections	—	1/6	1/6
Communicate your scientific ideas	—	1/6	—
Identify new alleles to use for improvement	—	1/6	—
Make phenotypic selections	—	1/6	—
Networking skills	—	1/6	—
Make genome wide selections	—	—	1/6
Leadership skills	—	—	1/6
Manage data	—	—	—
Consider alternative hypotheses	—	—	—
Molecular techniques	—	—	—
Utilize single nucleotide polymorphisms (SNPs) or genotype by sequencing (GBS)	—	—	—
Choose parents and make crosses	—	—	—
Mentoring skills	—	—	—
Resource management skills	—	—	—
Other	—	—	—

Table 17: Respondents' perceptions of the importance of plant breeding educational processes.

How important do you believe the following are in the process of educating graduate students?	Not important at all 1	2	3	4	Extremely Important 5
One-on-one mentoring	—	—	—	—	6/6
Exposure to diverse research methods and tools	—	—	—	—	6/6
Laboratory experience	—	—	—	—	5/5
Experience presenting results (meetings, papers)	—	—	—	—	5/5
Independent development of research designs	—	—	—	—	4/4
Field experience	—	—	—	—	4/4
Teaching experience	—	—	—	—	3/3
Independent development of hypotheses	—	—	—	—	3/3
Exposure to plant breeding students from different ethnic backgrounds	—	—	—	—	3/3
Experience writing grants	—	—	—	—	2/2
Collaboration with faculty other than the advisor	—	—	—	—	1/1
Collaboration with other graduate students in this institution (in this lab or other labs)	—	—	—	—	1/1
Collaboration with graduate students from OTHER institutions	—	—	—	—	1/1

Table 18: Respondents' collaborative networking with others.

How often have you interacted with the following types of people?	Never	Once a year or less	Once every three months	Once a month or less	Once a week or less	More than once a week
My advisee/s	—	—	—	—	2/5	3/5
Other students at my institution	—	—	—	1/5	2/5	2/5
Students from TCAP institutions	1/3	1/3	—	1/3	—	—
Students from other minority serving institutions (MSIs)	1/4	2/4	—	1/4	—	—
Non TCAP and non MSI students in the U.S.	—	1/4	1/4	—	1/4	1/4
Non TCAP and non MSI students from institutions outside the U.S.	2/4	1/4	—	1/4	—	—
Researchers at my institution	—	—	1/5	1/5	2/5	1/5
Researchers at TCAP institutions	—	—	2/6	2/6	2/6	—
Researchers at other MSIs	—	2/3		1/3	—	—
Other researchers at U.S. institutions (not TCAP or MSI researchers)	—	1/4	1/4	2/4	—	—
Other researchers outside of the U.S.	—	3/3	—	—	—	—
Researchers from businesses and/or private companies	1/3	1/3	1/3	—	—	—

Table 19: Topics of interaction between respondents and others.

What the most prevalent topic of your interaction was about?	Class assignments/ Classes in general	Trouble shooting research	Collaborations	Social	Mentoring/ Being mentored	Interpreting research results	Theory of genetics or breeding	Job prospects & professional networking	Other
My advisee/s	—	1/5	1/5	—	1/5	2/5	—	—	—
Other students at my institution	1/5	1/5	2/5	—	1/5	—	—	—	—
Students from TCAP institutions	—	—	2/2	—		—	—	—	—
Students from other minority serving institutions (MSIs)	—	—	1/3	—	1/3	—	—	—	1/3
Non TCAP and non MSI students in the U.S.	1/3	—		—	1/3	—	—	—	1/3
Non TCAP and non MSI students from institutions outside the U.S.	—	—	1/2	—	1/2	—	—	—	—
Researchers at my institution	—	—	4/5	—	—	—	—	—	1/5
Researchers at TCAP institutions	—	—	6/6	—	—	—	—	—	—
Researchers at other MSIs	—	—	1/2	1/2	—	—	—	—	—
Other researchers at U.S. institutions (not TCAP or MSI researchers)	—	1/4	1/4	—	—	2/4	—	—	—
Other researchers outside of the U.S.	—	1/3	1/3	—	—	1/3	—	—	—
Researchers from businesses and/or private companies	—	—	1/2	1/2	—	—	—	—	—