Student Project guidelines

Propose a sound approach to meet a specific breeding need or product target for one of the target species of MoBreed. A critical component of your application involves the demonstration that new genomic tools have become 'an arsenal of working knowledge' used in developing improved cultivars that contribute to national food security and economic vibrancy in sub-Saharan Africa. Applicants are encouraged to develop a proposal to strategically apply a new methodology or technology toward a meaningful breeding objective to increase genetic gains, accelerate the product development timetable, and/or improve efficiency. The proposal will state the rationale and approach in the context of principles of plant breeding and should be well integrated into national or regional plan. **The crop of focus will be one of the MoBreed project.**

Topic of interest may include (but not limited to):
- construction and deployment of a selection index for multiple trait selection to make progress simultaneously with negatively correlated traits;
- use of marker-assisted backcrossing (MAS) to introgress favorable alleles from wild relatives into elite cultivars, with validation of results;
- new design of a testing program featuring specific experimental designs for particular types of evaluations and/or various testing levels (e.g. preliminary testing vs. wide area performance testing before product release);
- Revamped breeding process (e.g. featuring a new breeding method) for new line development;
- analysis of target market region as to mega-environments and testing locations within mega-environments using GGE biplot analysis;
- plans to establish a specialized testing environment to collect data on an abiotic stress tolerance in breeding for improved yield under stress;
- establishing and developing a new heterotic pattern to create genetic diversity for hybridized crop or a crop initiating hybrid cultivars

Expected Outline

1) Title (descriptive statement of your focus, including crop common name and Latin genus-species name)
2) Background information on the crop (explain what is relevant as a backdrop for your proposed strategy so that the merit of your proposal can be assessed by one who has had little previous knowledge of your crop). This might include all/most of the following:
      a. crop uses, user groups
      b. history of domestication and genetic improvement
      c. botany, biology, reproductive mechanisms
            i. is your crop asexually or sexually propagated?
            ii. is it cross- or self-pollinated, or is there apomixis?
            iii. is self-incompatibility, male sterility, or genetic control of sex expression important in production or breeding of this crop?

        iv. What is the floral morphology and pollination technique for making crosses?

    d. cultivar types (are new releases open-pollinated varieties, hybrids, etc.?)

    e. known genetic aspects of the crop
        i. Ploidy level
        ii. Chromosome number
        iii. Genetic, physical, or cytological maps
        iv. Named genes related to traits of interest
        v. Marker sets
        vi. Is transformation an option in your crop?

    f. germplasm collections
        i. What are the centers of origin or centers of diversity for your crop and its related species?
        ii. List related species, which intercross with your crop.

    g. Key traits (What are the important characteristics of the crop? Which would be necessary for the ideal cultivar to have considering yield, quality and stress resistance?).
        i. reasons for importance of the trait
        ii. qualitative or quantitative; how many genes involved?
        iii. gene action, heritability (as per the literature), GxE
        iv. heterosis

3) Rationale (i.e. tell why the proposal will work and why the proposed strategy is better than the way the problem was addressed previously)
    a. What challenge does the proposal focus on?
    b. What previous approach is replaced?
    c. Why is the proposed approach better? What efficiencies are gained? Show the specifics of the expected benefit e.g. an increase in genetic gain (R) could be shown by calculating R with the current approach and with the proposed approach; a time savings could be shown by comparing current and proposed generational timelines

4) Breeding objective addressed (clearly state your relevant breeding objective in light of your product target and your target market region). This sets the stage for explaining how your new application fits in.

5) Proposed approach, which might include all/most of the following:
    a. sources of improved germplasm or favorable genes; choice of parents
    b. breeding plan
    c. breeding methods utilized
    d. testing regime: what, how, where?
    e. strategy for data analysis
    f. timeline
    g. technologies included and their use explained

6) This section serves as a summary of sorts. Forecast the outcome and impact of the new application to your breeding program, your organization, your crop end-user, etc.

7) Address risks associated with potential problems in implementing your proposal.

8) Outline budget needs for implementation. Depending on your project focus, you may also wish to describe projected savings with an improved approach.

9) References cited (Use format for Crop Science journal (http://crop.scijournals.org).