**Team Roles**

**Entrepreneurial Lead (EL)**

**Liz Koziol, Ph.D.**

Dr. Liz Koziol is a post-doctoral researcher with joint appointment at the Kansas Biological Station and the Land Institute in Lawrence, Kansas. Dr. Koziol is a mycologist; she has spent the last 9 years collecting mycorrhizal fungi from nature and isolating them in the laboratory. In previous collaborations with Dr. Bever, Dr. Koziol has conducted dozens of mycorrhizal inoculation trials across a variety of landscapes including prairie restorations as well as in agricultural systems. Dr. Koziol’s work has highlighted how important mycorrhizal fungi are to these systems and how including them can transform barren landscapes into productive plant communities. As a result of her work and others, there is widespread interest in (and need for) using ecosystem specific fungal amendments that is not currently being met. Dr. Koziol’s career objective is to develop locally adapted mycorrhizal fungi for grassland amendment that can be used by land managers to increase plant productivity, diversity, and ecosystem health.

**I-Corps Teams Mentor (IM)**

**Will Katz, B.A. M.B.A**

Mr. Katz brings to this collaboration variety of professional and management experience from companies both large and small. He spent seventeen years at E and E Display Group, beginning in 1987 and culminating with a stint as Production Manager. He has also served as a leader in Fortune 50 companies—General Motors and Target. Mr. Katz currently serves as the director for the University of Kansas and Lawrence Kansas, Small Business Development Center. In this capacity, Mr. Katz and others assist new and existing small business owners by providing seminars and free counselling services, with the goal of business improvement and growth. Through this work, he has experience connecting small business with various small business grants including the Small Business Innovation Research (SBIR). Mr. Katz’s expertise is exactly what this team needs to help transfer the scientific achievements of Drs. Koziol and Bever into commercially viable products.

**Technical Lead (TL) and Proposal Principal Investigator (PI)**

**James D. Bever Ph.D.**

Dr. Bever is a Distinguished Foundation Professor in the Ecology department at the University of Kansas. Dr. Bever has had an impressive and successful research career in ecology that has led to over 130 publications with more than 12,000 citations. Dr. Bever has received a number of awards relating to the role of mycorrhizal fungi in plant communities including those from the NSF, USDA, EPA, and the DOD. Dr. Bever also sits on the advisory panel for the International Culture Collection of Arbuscular Mycorrhizal Fungi (INVAM); one of only two research libraries of mycorrhizal fungi in the world. During the last several years, Dr. Bever has helped cultivate skills in Liz that can be directly applied to Liz’s career objective, such as the identification and culturing of mycorrhizal fungi and designing large experimental mycorrhizal inoculation projects. These skills are the core technology of this proposal. As there are currently fewer than 10 arbuscular mycorrhizal fungal systematists in the world, three nationally, the skills Dr. Bever has transferred and will continue to transfer to Liz are rare and difficult to acquire.

**Lineage of the Proposed Innovation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Award Source/Year** | **Award Program** | **Award number** | **Award Winner** | **Award Title** |
| USDA  2016-2018 | AARFI Competitive Grant | 2016-67012-24680 | Jonathan Bauer & **James D. Bever** | Ecosystem services and plant diversity in re-established grasslands; a study of restoration chronosequences |
| USDA  2016-2017 | AARFI Competitive Grant | 2016-67011-25166 | **Liz Koziol & James D. Bever** | Mycorrhizal fungal amendments improve productivity and the delivery of ecosystem services in grasslands |

**Our Core Technology:**

The core technology of this proposal is the development of locally adapted, reference ecosystem mycorrhizal products. Mycorrhizae are belowground soil fungi that associate with more than 80% of plant species and can make plants more productive and help seeds and seedlings establish. Research suggests that mycorrhizae can provide other benefits to plants as well, including resistance to herbivores and improved drought tolerance. However, studies have found that the currently available commercial mycorrhizae are often ineffective—both because they are not adapted to the environmental and soil conditions where they are being applied and sometimes, because they are simply not good growth promoters. While it has long been accepted that locally adapted plant sources work best in their native environment, this concept is only recently being applied to mycorrhizae, mainly in research applications. Currently, there are no regional or ecosystem specific mycorrhizal amendments commercially available.

As part of the above grants, we have collected distinct geographical populations of mycorrhizae from native prairie grasslands that have been shown to be good growth promoters within new agricultural fields, for grassland restoration and pasture plantings, for garden fruits and vegetables, and in commercial nursery propagation. Because our mycorrhizae are geographically distinct, they also vary in the environmental conditions from which they are adapted to. For instance, our Oklahoma mycorrhizae are adapted to clay soils and frequent drought events while other populations we maintain are adapted to areas that receive nearly 50 inches of rain per year. We hope to incorporate this data and research on our core technology into a set of commercial products that would allow customers to choose a product that is best suited to their environment.

**Potential Commercial Application/Market:**

There are currently around 8 significant mycorrhizal amendment companies, including RTI Xtreme Gardening, ProMix and Mycorrhizal Applications—each raking in 1-10 million in annual sales. Customers seek mycorrhizal amendments for a variety of plant growing needs and mycorrhizal products are specifically targeted toward different uses. Customers use mycorrhizae because they want to improve plant productivity in: 1) container gardening and plant nursery growing application, 2) backyard vegetable gardens, 3) agricultural fields with potatoes, peas, beans, roses, and many other crop species 4) the cannabis industry, 5) native plantings and landscaping and 6) within hydroponic systems. Mycorrhizae often touted as a natural way to improve plant growth without fertilizers, so they have many uses in organic agriculture as well. We have tested our core technology (locally adapted mycorrhizae) in many of these applications and are confident that they will be able to satisfy these types of customers.

However, currently none of the prominent mycorrhizal amendments companies provide ecosystem specific or regional specific mixtures of mycorrhizal amendments. A recent *Ecological Restoration* article highlighted that more than 75% of conservation and nursery professionals use local ecotype plant material and are willing to pay more for it. As nursery professionals are being pushed to grow more locally sourced plants, the idea of local source has begun to transfer mycorrhizal products. Yet this market need has not been met.

We are in a unique position to be able to provide locally adapted and/or ecosystem specific mycorrhizal products to this new customer. Our core innovation is the direct result of the research of Drs. Koziol & Bever which illuminated that locally sourced mycorrhizae performed better than to commercial mycorrhizae across numerous projects. Through this work, we have convinced some native plant growers that they should also include native, locally sourced mycorrhiza. Thus, we have created a need for locally adapted or reference ecosystem mycorrhizae products. Our laboratory has been approached by nursery professionals, restoration companies, academics, and agricultural and conservation planners to contract grow locally adapted mycorrhizae for them. Our goal is to design a product to fill this market gap—a product that can also compete with those who currently purchase generic mycorrhizae products from the existing mycorrhizal companies (i.e. ProMix). We intend to utilize the unique, reference ecosystem collections of mycorrhizae that we have already proven experimentally to be effective in our numerous published articles.

**Current Commercialization Plan:**

Drs. Koziol & Bever have established proof of concept for these local/reference ecosystem fungi in grassland restoration and agricultural plantings from their academic research. They have published numerous studies where they have found these mycorrhizae to improve the establishment and productivity of a wide variety of plants from very rare prairie species, to entire grassland/pasture communities, to alfalfa fields. Dr. Bever’s impressive and successful research career in ecology along with his advisory position at the international mycorrhizal library (INVAM) allow him to be a trusted technical and scientific support for the concept of these mycorrhizal amendments.

To move this concept forward, Dr. Koziol initiated MycoBloom LLC, a business that provides small quantities of mycorrhizae. MycoBloom’s mycorrhizae are a great example alpha protype of what commercialization could mean for these mycorrhizae. MycoBloom’s fungi have been used in non-collaborative research applications and in 2017 a product was made available for purchase. However, MycoBloom sells one distinct mycorrhizae mixture, has extremely limited production capability and will sell out before the end of its first sales year. To assess whether it is feasible for MycoBloom or a similar company to include a variety of local/reference ecosystem mycorrhizal products, Dr. Koziol could benefit from the joint learning and exploratory nature of this proposal.

We would like to use this proposal to: 1) increase the entrepreneurial skills of Dr. Koziol, 2) develop methods to increase the production capability of mycorrhizal inocula that can be manufactured at one time (i.e. bulking up our alpha prototype) and 3) to use customer discovery to test the market size and need for regional/ ecosystem specific mycorrhizal mixes (a beta protype goal of this proposal and future SBIR type funding). Ideally, we would use this proposal to transition the proof of concept we have created for locally adapted mycorrhizae into alpha prototypes we can deliver to some of our potential future customers for testing.