Nebraska Soybean Board

Year-End Summary Research Report Form For Multi-Year Projects

DS VB

11/7/2018

Please use this form to summarize the practical benefits of your research project and what has been accomplished.

Your answers need to convey why the project is important and how the results will impact soybean production.

Note that this form must be submitted with the 4th Quarter Report in all multi-year projects.

Project Title: #1727 Improve soybean resistance to Nematodes with synthetic RNA interference

Principal Investigator: Bin Yu

Year of Multi Year: 2 ***of*** 3 ***(For example: Year 1 of 3, Year 2 of 2)***

1. ***What was the focus of the research project or educational activity?***

As the most destructive pest disease for soybean, The soybean cyst nematode (SCN) costs huge losses every year. This project is expected to develop novel technology to generate soybean varieties with high resistance to SCN. We will use four different Pol III promoters to drive the expression of four short hairpin RNAs at the same time in soybean, respectively. Each short hairpin RNAs (shRNAs) will repress the expression of an essential gene of SCN when consumed by SCN, resulting in death of SCN. In addition, the adaption of SCN to this variety will be also examined. Furthermore, we will examine the combination of natural SCN resistant trait with shRNAs will reduce the SCN adaptation. This aspect is less explored in the field.

2. ***What are the major findings of the research or impacts of the educational activity?***

We have generated transgenic soybean plants expressing the shRNAs and currently testing their SCN resistance. We also designed additional vector are in the process for transformation. , we also further optimized deep-seq based method to identify the insertion position of transgene and transposons in soybean. This is important since knowing the transgene insertion position is fundamental to the application of crop engineering and the method is accurate and cost-efficient. This method is based on the newly developed nanopore technology that sequence long DNA fragments. We believe this method will have important impact on soybean breeding and application of transgenic technologies.

3. ***Briefly summarize, in lay terms, the impact your findings have had, or will have, on improving the productivity of soybeans in Nebraska and the U.S.***

As the most destructive pest disease for soybean, SCN cost huge losses every year. However, the limited number of resistant soybean varieties has challenged the management of SCN. This project will generate a SCN resistant soybean variety, and therefore has the potential to help the management of SCN and to benefit soybean production in US including Nebraska. In addition, this project applies the next generation RNAi technology to improve soybean traits. If succeed, it will open doors to apply this technology to improve other important soybean traits, such as fungi disease resistance. Thus, this project should have the potential to benefit soybean production more broadly. Moreover, this study will study the adaption of SCN to this strategy and combined this strategy with natural SCN resistance. We expect this combination will reduce the adaption and help soybean breeding in long run in an environmental friendly and cost efficiently way.

4. ***Describe how your findings have been (or soon will be) distributed to (a) farmers and (b) public researchers. List specific publications, websites, press releases, etc.***

Wang, X., Wang, Y., Dou, Y., Chen, L., Wang, J., Jiang, N., Guo, C., Yao, Q., Wang, C., Liu, L., Yu, B., Zheng, B., Chekanova, J.A., Ma, J. and Ren, G. (2018) Degradation of unmethylated miRNA/miRNA*s by a DEDDy-type 3' to 5' exoribonuclease Atrimmer 2 in Arabidopsis. Proceedings of the National Academy of Sciences of the United States of America, 115, E6659-E6667.
Li, S., Xu, R., Li, A., Liu, K., Gu, L., Li, M., Zhang, H., Zhang, Y., Zhuang, S., Wang, Q., Gao, G., Li, N., Zhang, C., Li, Y. and Yu, B. (2018) SMA1, a homolog of the splicing factor Prp28, has a multifaceted role in miRNA biogenesis in Arabidopsis. Nucleic Acids Res. 46:9148-9159
Wang, Z., Ma, Z., Castillo-Gonzalez, C., Sun, D., Li, Y., Yu, B., Zhao, B., Li, P. and Zhang, X. (2018) SWI2/SNF2 ATPase CHR2 remodels pri-miRNAs via Serrate to impede miRNA production. Nature, 557, 516-521.
Zhang, S., Dou, Y., Li, S., Ren, G., Chevalier, D., Zhang, C. and Yu, B. (2018) DAWDLE Interacts with DICER-LIKE Proteins to Mediate Small RNA Biogenesis. Plant Physiol, 177, 1142-1151.
Li S, Liu K, Zhang B, Li, M, Zhang S, Zhang C and Yu B (2017) MAC3A and MAC3B, Two Core Subunits of the MOS4-Associated Complex, Positively Influence miRNA Biogenesis Plant Cell 30:481-494

5. ***Did the NE soybean checkoff funding of your project, leverage additional State or Federal funding support? Please list sources and dollars approved.***

Understand the function of the MOS4-associated complex in microRNA biogenesis (PI)
NIH R01GM127414
Amount: $1,570,405
Period: 09/01/2018 - 08/31/2023

Understand the functional mechanism of the DSP1 complex in the 3' maturation of plant small nuclear RNAs (PI)
NSF MCB-1818082
Amount: $682,608
Period: 08/01/2018 - 07/31/2021

Please e-mail this report to the Agriculture Research Division (jmonagham2@unl.edu).