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| Project Title | Soybean yield components and seed nutrient concentration responses among nodes to phosphorus fertility |
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| Research Locations (and states involved) | University of Arkansas System Division of Agriculture's Rice Research and Extension Center (RREC), located in Stuttgart, Arkansas. LSU AgCenter – Macon Ridge Research Station (MRRS), located in Winnsboro, Louisiana.  |
| **Timeline:** **Current Year - FY22** | **Multi-Year Project Information** (if applicable) |
| Year 1 | Year 2 | Year 3 |
| Start Date |  | **25 March 2021** |  |  |
| End Date |  | **31 March 2022** |  |  |
| Funds Requested | $ | $ 35,355 | $ 35,266 | $ |
| **Program Area: Fertility needs (especially P and K) for optimum and economical yield** |
| Objectives | Evaluate the effects of P fertility on soybean seed yield, selected yield components, the pattern of tissue P concentration across time, and seed nutrient concentration among nodes. Specifically, we seek to identify how seed yield, individual yield components, leaflet-P concentration, and seed nutrient concentrations are affected by P deficiency. |
| Justification | Soybean is widely cultivated on soils with limited P availability. Investigating whether soybean yield, yield components, and the seed nutrient concentration among nodes are affected differently by P deficiency will help to develop more efficient fertilization practices and improve methods for monitoring plant P nutrition and yield potential. |
| Exp Setup | Field trials will be carried out from 2021 to 2023 in a long-term site varying in soil P availability (low to high) in Arkansas and in a new fertilizer-P rate trial established in 2021 on a P-deficient site in Louisiana. We will evaluate leaflet-P concentration across time and soybean seed yield, individual seed weight, pod and seed numbers per plant, seed abortion, and seed nutrient concentrations among nodes at maturity of soybean grown under different soil and P availability levels created with different fertilizer-P rates (0, 40, 80, 120, and 160 lb P2O5/ac).  |
| Summary  | This multi-year/state project will help to develop more efficient P fertilization practices for the US Mid-South soybean producers. The trials at both locations (Arkansas and Louisiana) have shown visual plant growth differences indicating potential yield differences among fertilizer-P treatments, which is ideal for the purpose of this research. Trials will be replicated in the next two harvest seasons to build a robust dataset that will allow us to develop critical tissue-P concentrations for near-maximum soybean yield and provide better information on how soybean yield components are affected by deficient, low, and optimal P availability.  |
| Key Metrics | Measurements include grain yield, tissue P concentration and seed-P concentration among nodes. The cumulative, 3-year results will be published in an appropriate peer-reviewed journal (e.g., Agronomy Journal), experiment station reports, included in the Arkansas Soybean Production Handbook, and shared via oral or poster presentations at professional meetings. The information could eventually be used to develop a dynamic decision support tool. |
| Expected Deliverables | We expect to identify the patterns of tissue P concentration across time, how P and other nutrients are allocated among seeds at different positions, and which yield components and nodes are affected by P deficiency. |
| Benefit to midsouth farmers | First, understanding how P deficiency influences individual yield components and the seed yield on specific nodes is affected will indicate whether post-emergence applications fertilizer-P would be effective in rescuing P-deficient plants. Second, unlike, corn, the symptoms associated with P deficiency of soybean are subtle and often hard to visually identify. Laboratories that perform tissue analysis rely on leaf-P concentrations at the R2 growth stage to diagnose P deficiency, but we can find no published research that supports critical leaf-P concentrations. We know that leaf-P concentration changes as plants progress through flowering, pod set, and seed development. The use of unsubstantiated critical concentrations result in erroneous interpretation of tissue analysis and potentially uneconomical fertilization decisions. An improved understanding of and the ability to accurately diagnose P deficiency will positively impact the production economics, agronomics, and the environment.  |
| Progress Made | A P fertilization trial has been established on a Gigger-Gilbert silt loam soil at the LSU AgCenter – Macon Ridge Research Station, Winnsboro, LA. Five fertilizer-P rates (0, 40, 80, 120, and 160 lb P2O5/ac) were broadcast on the top of the seedbed the same day as planting. Pioneer P48A60X soybean was planted on April 27th and soybean leaf samples were collected weekly starting on June 4th at the R1 growth stage (beginning of flower). The Arkansas trial is being conducted within a long-term trial established in 2007 at the Rice Research Extension Center in Stuttgart, AR on a Dewitt silt loam. The trial is cropped to rice and soybean rotation and receives fertilizer-P applied to the same plots annually (0, 40, 80, 120, and 160 lb P2O5/ac). The annual fertilizer-P treatments were applied on May 21st and Pioneer 52A43L soybean was planted on May 26th. Soybean emerged on June 3rd and leaf samples were collected on June 30th (V4/V5), July 8th (V6/V7), and thereafter weakly starting on July 21st when soybean was at the R1 growth stage.Tissue samples from both trials will be collected until the R6 growth stage (full-seed). Soybean will be harvested at maturity (R8), when soybean yield, yield components, and seed nutrient concentration will be accessed. |
| Signature of Principle Investigator | Date: |
|  | 7/30/2021 |