

A Strategy for Prioritizing Research Goals and Outreach Plans to Reduce Soybean Production Losses Caused by Stink Bugs and Related Insect Pests

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Critical needs for research.

Regional differences exist in species composition, infestation levels, and economic impact:

- Determine and quantify the effects on soybean yield, seed quality, and crop value
- Determine basic stink bug biology and ecology across the soybean farmscape
- Develop integrated pest management (IPM) strategies
- Implement extension and information delivery and outreach programs

Determine and Quantify Effects on Yield, Seed Quality, and Crop Value

- Quantify soybean seed yield loss in stink bug managed vs. non-managed control plots and in cage experiments
- Obtain yield loss estimates at the county level – acres infested/treated, cost of control, percent yield and quality reduction
- Quantify impact on seed quality
 - (a) effects on seed shape, size, and composition
 - (b) identify pathogens on damaged seed
 - (c) establish criteria to distinguish seed quality problems caused by stink bugs vs. weather
 - (d) validate USDA grain quality standards for stink bug injury
 - (e) effects of stink bug damage on planting seed germination rates and seed/seedling vigor

Determine and Quantify Effects on Yield, Seed Quality, and Crop Value

- Assess the role of stink bug-type pests in delayed crop maturity (green bean syndrome)
- Determine relative seed damage and injury among stink bug species
- Identify interactions among growth stage, infestation level, and duration

Basic Biology

- Understand the reproductive biology, phenology, and life cycle of the emerging stink bug species (BMSB, redbanded stink bug, and kudzu bug).
 - (a) investigate number of generations per year
 - (b) determine fecundity, longevity, and survivorship
 - (c) identify and quantify parasitism, predation, and diseases
- Determine temperature and photoperiod requirements to develop degree-day models to predict spring emergence and generation phenology.
- Identify pheromones associated with BMSB, redbanded stink bug, and kudzu bug.
- Characterize phenology and utilization of other host plants serving as sources of infestations in soybeans.

Basic Biology

- Conduct adult and nymphal feeding studies to ascertain the effects of feeding injury and potential pathogen transmission relative to life stage
- Determine the key factors associated with overwintering biology, identify induction and emergence triggers, and gather information on overwintering sites
- Conduct spatiotemporal distribution studies that provide information on the dynamics of infestations relative to: (a) adjacent habitats, (b) within-field environment, and (c) within-plant morphology.

Pest Management (IPM)

- Cultural: develop standardized screening methods to evaluate thousands of genotypes (correlate with field performance); (b) breed for resistance (gene and QTL mapping); (c) use of trap crops combined with chemical treatment to field edges.
- Investigate classical biological control (three emerging pest species). Document dispersal, establishment, and effectiveness.
- Thresholds revisions are needed.
- Sampling Methods:(a) sampling methods need to be standardized. The method needs to account for species, life stages, and production systems;(b) identify pheromones by species (invasive species)
- Chemical Management integrated with other management practices to develop an effective and practical IPM program.

Extension

- Document (web) the distribution and spread of invasive species (BMSB, kudzu bug, and redbanded stink bug).
- Document state-by-state insect loss estimates for soybean. The loss estimates document both regional and historical changes in pest pressure and control costs, and thus, identify critical IPM needs for soybean in the South.
- Web-based publications and blogs to deliver educational materials and news updates about stink bug management.
- Evaluate and demonstrate IPM recommendations (sampling methodology, action thresholds, and insecticides efficacy). Determine seed quality and relative stink bug damage levels by collecting grain samples from representative growers.

USB funded projects

- Three projects funded to determine the impact on seed yield, quality and crop value of the pests and to gather biological, ecological and pest management information on each of the new species (red-banded stinkbug, brown marmorated stink bug, and kudzu bug).
- One project funded to perform a field and lab screening of the germplasm collection for resistance to red banded stink bug.