MISSISSIPPI SOYBEAN PROMOTION BOARD
PROJECT NO. 15-2015 (CONT)
2015 Annual Report

Title: Soybean disease monitoring for Mississippi soybean producers **(Project #15-2014)**

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BACKGROUND AND OBJECTIVES

Soybean diseases continue to annually reduce soybean yield in Miss. Since the initial observation of soybean rust in 2004, the foliar disease has been one of the most closely monitored plant diseases in the United States. Sentinel plots have been a valuable tool to aid soybean farmers in making informed management decisions based on the particular economically important disease(s) present in sentinel plots.

Mississippi has cooperated at the regional and national level by monitoring for soybean rust in early-planted sentinel plots which are typically planted several weeks prior to the commercial soybean crop. The information gained from sentinel plots has been relied on by farmers throughout Miss. to avoid yield losses as a result of soybean rust and other economically important diseases, or to avoid losing money by making an ill-timed fungicide application when disease is not threatening.

Beginning in 2011/2012, MSU faculty and staff emeritus began to use sentinel plots as well as commercial soybean fields to monitor for all economically important soybean diseases, particularly those that could be managed with a timely fungicide application. In addition to monitoring for the presence of economically important foliar diseases (e.g, aerial web blight, Cercospora blight, frogeye leaf spot, soybean rust), we also started to use sentinel plots to monitor for the presence of fungicide resistance within the frogeye leaf spot fungal population in 2013. In 2012 two counties (Carroll and Coahoma) were reported to contain strobilurin-resistant frogeye leaf spot. At that time leaf samples were submitted to the University of Illinois for resistance screening. However, beginning in the 2013 season, leaf samples were screened in Starkville, MS due to some issues encountered while shipping samples. At present, MSU has its own fungicide resistance screening program that is led by Dr. Maria Tomaso-Peterson and a graduate student (Mr. Jeff Standish). The strobilurin class of fungicides (or QoI fungicides) have been widely used in soybean production systems throughout Miss. and have provided farmers with a broad-spectrum fungicide that has additional benefits when it comes to enhancing yield in continuous soybean situations. However, the members of this particular class of fungicides have a high risk for developing resistance within fungal populations.

The main objective of the soybean disease monitoring project is to determine where important yield-limiting diseases may be occurring (inclusive of soybean rust) and disseminate pertinent information in the form of management alternatives when necessary using several different media sources so that farmers are aware of a potential threat. Throughout the growing season, Billy Moore, Malcolm Broome, and Tom Allen scouted for soybean diseases throughout the state in commercial soybean fields as well as the 23 sentinel plots that were planted in counties along the edges of the state to serve as an early warning system for important diseases.

REPORT OF PROGRESS/ACTIVITY

OBJECTIVE(S):

1. **Monitor for foliar soybean diseases throughout Miss. to provide soybean farmers the necessary information to make informed, timely decisions regarding fungicide application(s) as well as product choices (either strobilurin or triazole) depending on the specific disease(s) present in commercial fields.**

Soybean sentinel plots, planted earlier than the commercial soybean crop throughout the state, were used to monitor soybean diseases throughout Miss. during the 2015 season. Sentinel plots consisting of a Maturity Group IV and V and VII variety were planted in 22 counties (Adams, Amite, Claiborne, Coahoma, Hancock, Hinds, Issaquena, Jackson, Jefferson, Monroe, Newton, Noxubee (2), Pearl River, Pike, Tippah, Tishomingo, Walthall, Warren, Washington, Wayne, and Wilkinson). In addition, six of the locations were surrounded by electrified fencing to reduce deer browsing (Adams, Amite, Coahoma, Jefferson, Wayne, and Wilkinson) since the sentinel plots were deemed to be in extremely important locations.

In addition to scouting sentinel plots on a weekly basis between April and September (or when they reached R8; physiological maturity), more than 450 unique commercial soybean fields and more than 300 kudzu patches were observed during the 2015 (see map included as Figure 1) season with the help of Billy Moore and Malcolm Broome as well as Jack Bridgers (Jimmy Sanders, Inc.). In addition to scouting for diseases of economic concern, commercial soybean fields were observed for the presence of important diseases as well as nematode issues (a list of the major disease and nematode observations made during the 2015 season is included below). If a management practice was necessary to reduce the impact of a particular disease the information was reported to the farmer so that the situation could be addressed.

As a final report for the 2015 soybean season several economically important diseases were observed in either sentinel plots or commercial soybean fields:

Foliar fungal diseases:
-aerial web blight
-bacterial blight
-brown spot (Septoria leaf blight)
-Cercospora blight
-downy mildew
-frogeye leaf spot
-soybean rust
-target spot

Soilbore diseases:
-charcoal root rot
-Phytophthora root rot
-southern blight
-stem canker
-sudden death syndrome
-taproot decline

Viruses:
-*Bean pod mottle virus*
-*Soybean mosaic virus*
-*Soybean vein necrosis virus*

Nematodes:
-reniform nematode
-root-knot nematode
-soybean cyst nematode

One important note regarding the diseases outlined above. Similar to the disease situation over the past several seasons, soybean viruses were widespread in the MS soybean production system.

Normally foliar viruses are a limited occurrence; however, during 2015 foliar viruses were observed on a statewide basis in large part due to extremely large bean leaf beetle populations, which serve as a vector for several foliar soybean viruses. Virus diseases were observed at about the same time (growth stage and month) as they were observed during previous seasons. With that in mind, determining the potential yield loss as a result of viruses is difficult at best. On an annual basis, virus diseases account for some yield loss; however, an actual number that could be attributed to yield reduction as a result of viruses would be difficult to assess.

2. <u>If the ability arises,</u> determine the most effective fungicide management schemes by conducting efficacy trials specifically for soybean rust (SBR) timing. In addition, if strobilurin-resistant aerial web blight, Cercospora blight or frogeye leaf spot are identified fungicide trial plots could provide valuable information to the soybean industry (if identified early enough to benefit the situation).

During 2015, soybean rust observations were not made until later in the cropping season, typically August and September, when the majority of soybean grown in the state had reached a growth stage where foliar diseases will not result in a yield reduction. As a result, efficacy trials could not be conducted to determine fairly late disease entry throughout much of Miss. and fungicide trials would have been too late even on the earliest- or latest-planted soybean trials. However, frogeye leaf spot was one of the most predominant diseases, and again a late entry into the Miss. soybean production area. Therefore, fungicide trials to specifically manage soybean rust were not conducted.

However, several different types of fungicide trials were conducted to determine the role of "early" fungicide application strategies to manage Cercospora leaf blight as well as frogeye leaf spot in Starkville and Stoneville. Fungicide trials were conducted on the experiment station in Stoneville to determine efficient timing strategies to manage soybean diseases as well as overall yield losses. Reports from those trials will be published in the Plant Disease Management reports journal through the American Phytopathological Society.

Application strategies during 2015 included strobilurins, pre-mix fungicides, several triazole products applied at the below timings. The information obtained from these trials will be used for several blog articles (www.mississippi-crops.com) as well as drafting several Plant Disease Management Reports to be published through APS.

-V5 alone both with and without glyphosate/glufosinate
-V5 followed by (fb) R5
-R2
-R4
-R5 alone (multiple trials in Stoneville and one trial in Starkville)
-R6 at one location in Stoneville

In addition, trials were conducted on full-season soybean planted in April/May as well as double-crop soybean planted following wheat.

Generally speaking, regardless of timing strategy, fungicides did not reduce the observable symptoms from Cercospora blight. However, a tremendous data set was created from the trials conducted to manage frogeye leaf spot, especially in the trials conducted since the fungus was determined to be resistant to the strobilurin fungicides at all locations during 2014.

3. Continue to monitor the environmental conditions at 3 locations (Eden, Hurley, Pond) where weather stations are present to determine if a specific correlation exists between environmental variables and infection of the local plant material (either kudzu or soybean) by the SBR fungus.

Weather stations continue to be monitored at three key locations (Eden, Hurley, Pond, MS) where soybean rust has been a regular occurrence. At present we are working with the weather monitoring group in Stoneville, MS to upgrade the three weather stations with cellular uplinks. These improvements at those locations will increase the environmental data coverage throughout the state by providing excellent information for soybean farmers and researchers. Moreover, the station locations will be slightly moved to fill in gaps in the environmental information provided from MSU.

4. Continue to make weekly radio updates during the soybean growing season for the Mississippi Radio Network (via Mr. Lynn Sheldon and/or Mr. John Winfield) on important topics occurring in soybean pathology or other pathology-related issues (e.g. foliar diseases, nematodes, fungicide application suggestions, presence of particular diseases and their proximity to the major production areas).

During the 2015 season, radio updates regarding pertinent disease information were made to the MS Ag Network. The information that was contained in those reports was also pertinent to disease monitoring as well as structured around providing information that would benefit farmers' management practices regarding important yield-limiting diseases. A list of the specific titles and topics is included in the appendix below.

IMPACTS AND BENEFITS TO MISSISSIPPI SOYBEAN PRODUCERS

Ideally, monitoring for yield limiting diseases throughout Miss. impacted all of the farmers that managed the approximately 2.3 million acres of soybean in the state. During 2015, the soybean disease monitoring team that included Billy Moore, myself, and Malcolm Broome observed more soybean acres in MS than any other single entity. Our weekly visits to soybean farms, sentinel plots, and kudzu patches throughout the state provided constant benefit to soybean farmers by showing we are aware of their needs as well as monitoring their crop acres should an issue arise.

In locations where soybean rust was confirmed in field situations where a fungicide may have produced a positive benefit, we were able to protect yield; however, based on the late entrance of the disease into Miss. during 2015, the use of fungicides was determined to be unnecessary to manage for just soybean rust. As has been the case over the past several years, we were also able to provide important information for the subsequent soybean season regarding such diseases as red crown rot, stem canker, frogeye leaf spot, root-knot, reniform, and soybean cyst nematode.

END PRODUCTS–COMPLETED OR FORTHCOMING

Throughout the 2015 season updates, were provided to the farming community through the Mississippi Crop Situation Blog (www.mississippi-crops.com) as well as radio interview/updates on pertinent disease management issues by way of the Mississippi Radio Network. Funds

provided by the MSPB allowed us to spend considerable time throughout the state to determine what diseases were present, where they were located, and provide this information to farmers through several different outlets.

The specific Extension-related outputs are included in the appendix below.

APPENDIX 1:

Poster presentations (n=4)

Aboughanem-Sabanadzovic, N., Lawrence, A., **Allen, T. W.**, and Sabanadzovic, S. 2014. Prevalance and diversity of viruses infecting *Macrophomina phaseolina* in the United States. Phytopathology 104 (Suppl. 3):S3.2.

Brochard, N., Standish, J., Tomaso-Peterson, M., and **Allen, T. W.** 2014. Distribution of azoxystrobin resistant *Cercospora sojina* throughout soybean production fields in Mississippi. Phytopathology 104 (Suppl. 3):S3.19.

Aboughanemi-Sabanadzovic, N., Moore, W., **Allen, T. W.**, Lawrence, A., and Sabanadzovic, S. 2014. Kudzu as a reservoir for soybean viruses. Phytopathology 104 (Suppl. 3):S3.2.

Wilkerson, T. H., **Allen, T. W.**, Bolden, B. R., and Irby, J. T. 2014. Frogeye leaf spot management with timed fungicide applications in the Mississippi soybean production system. Phytopathology 104 (Suppl. 3):S3.129.

Publications associated with soybean disease monitoring (n=1):

Murillo-Williams, A., Esker, P., **Allen, T.W.**, Stone, C., and Frederick, R. 2015. First report of *Phakopsora pachyrhizi* on soybean in Costa Rica. Plant Disease 99:418.

Technical bulletins (Plant Disease Management Reports; n=9):

Allen, T.W., Wilkerson, T.H., Mansour W.J., and Solomon, W.L. 2015. Evaluation of the BASF foliar fungicide protocol in western Mississippi, 2014. Plant Disease Management Reports (online). Report 9:FC110.

Solomon, W.L., Wilkerson, T.H., Mansour W.J., and Allen, T.W. 2015. Evaluation of the Bayer foliar fungicide protocol in western Mississippi, 2014. Plant Disease Management Reports (online). Report 9:FC112.

Solomon, W.L., Wilkerson, T.H., Mansour W.J., and Allen, T.W. 2015. Evaluation of the Aceto Ag fungicide protocol on soybean in western Mississippi, 2014. Plant Disease Management Reports (online). Report 9:FC107.

Allen, T.W., Solomon, W.L., Wilkerson, T.H., and Mansour, W.J. 2015. Evaluation of the Cheminova foliar fungicide protocol on soybean in western Mississippi, 2014. Plant Disease Management Reports (online). Report 9:FC106.

Allen, T.W., Solomon, W.L., and Irby, J.T. 2015. Efficacy of foliar fungicides for management of *Cercospora sojina* on soybean in east Mississippi II, 2014. Plant Disease Management Reports (online). Report 9:FC114.

Allen, T.W., Solomon, W.L., and Irby, J.T. 2015. Efficacy of foliar fungicides for management of *Cercospora sojina* on soybean in east Mississippi I, 2014. Plant Disease Management Reports (online). Report 9:FC113.

Allen, T.W., and Solomon, W.L. 2015. Evaluation of Priaxor foliar fungicide plus demethylation-inhibitor products in western Mississippi, 2014. Plant Disease Management Reports (online). Report 9:FC111.

Solomon, W.L., Mansour, W.J., Wilkerson, T.H., and Allen, T.W. 2015. Evaluation of the Marrone foliar fungicide protocol on soybean in western Mississippi, 2014. Plant Disease Management Reports (online). Report 9:FC109.

Solomon, W.L., Wilkerson, T.H., Mansour, W.J., and Allen, T.W. 2015. Evaluation of the Viva, Inc. foliar fungicide protocol on soybean in western Mississippi, 2014. Plant Disease Management Reports (online). Report 9:FC108

Mississippi Crop Situation Blog updates (n=18)

Irby, T., and Allen, T. 2015. Disease Ratings for 2015 MSU-ES Soybean Variety Demo Program. December 4, 2015. http://www.mississippi-crops.com/2015/12/04/update-disease-ratings-for-2015-msu-es-soybean-variety-demo-program/

Irby, T., Allen, T., Falconer, L., Golden, B., and Krutz, J. 2015. Tri-State Soybean Forum – January 8, 2016. December 4, 2015. http://www.mississippi-crops.com/2015/12/04/tri-state-soybean-forum-january-8-2016/

Allen, T. 2015. 2015 North MS Maturity Group IV and V Variety Trial Report. November 25, 2015. http://www.mississippi-crops.com/2015/11/25/6916/

Buehring, N.W., Harrison, M.P., Allen, T., and Taylor, A.R. 2015. 2015 North MS Maturity Group III Variety Trial Report. November 25, 2015. http://www.mississippi-crops.com/2015/11/25/2015-north-ms-maturity-group-iii-variety-trial-report/

Allen, T. 2015. 2015 Soybean OVT Foliar Disease Ratings: Maturity Group V. November 20, 2015. http://www.mississippi-crops.com/2015/11/20/2015-soybean-ovt-foliar-disease-ratings-maturity-group-v/

Allen, T. 2015. 2015 Soybean OVT Foliar Disease Ratings: Maturity Group IV. November 18, 2015. http://www.mississippi-crops.com/2015/11/18/2015-soybean-ovt-foliar-disease-ratings-maturity-group-iv/

Allen, T. 2015. 2015 Soybean OVT Stem Canker Ratings. November 14, 2015. http://www.mississippi-crops.com/2015/11/14/2015-soybean-ovt-stem-canker-ratings/

Allen, T. 2015. First Look: 2015 North MS Research and Extension Center Soybean Disease Ratings. October 31, 2015. http://www.mississippi-crops.com/2015/10/31/first-look-2015-north-ms-research-and-extension-center-soybean-disease-ratings/

Allen, T. 2015. Are Late-Season Soybean Rust Observations Important? September 22, 2015. http://www.mississippi-crops.com/2015/09/22/are-late-season-soybean-rust-observations-important/

Allen, T. 2015. Late-season Soybean Disease Clinic: Baldwyn, MS, September 15, 2015. http://www.mississippi-crops.com/2015/09/14/late-season-soybean-disease-clinic-baldwyn-ms-september-15-2015/

Allen, T., Irby, T., and Orlowski, J. 2015. Soybean Disease Update: September 5, 2015. http://www.mississippi-crops.com/2015/09/05/soybean-disease-update-september-5-2015/
Allen, T. 2015. Soybean Disease Update: August 8, 2015. http://www.mississippi-crops.com/2015/08/08/soybean-disease-update-august-8-2015/

Allen, T. 2015. Soybean Disease Update: July 31, 2015. http://www.mississippi-crops.com/2015/08/01/soybean-disease-update-july-31-2015/

Allen, T., Diagnosing Fungicide Phytotoxicity and Telling Apart from Root Diseases. July 22, 2015. http://www.mississippi-crops.com/2015/07/22/diagnosing-fungicide-phytotoxicity-and-telling-apart-from-root-diseases/

Allen, T., and Irby, T. 2015. Soybean Disease Update: July 18, 2015. http://www.mississippi-crops.com/2015/07/18/soybean-disease-update-july-16-2015/

Allen, T. 2015. 2014 Frogeye Leaf Spot and Cercospora Blight Foliar Fungicide Trials: Trial Data. July 5, 2015. http://www.mississippi-crops.com/2015/07/05/2014-frogeye-leaf-spot-and-cercospora-blight-foliar-fungicide-trials-trial-data/

Allen, T. 2015. Soybean Disease Update: July 5, 2015. http://www.mississippi-crops.com/2015/07/05/soybean-disease-update-july-5-2015/

Allen, T., and Irby, T. 2015. Automatic Soybean Fungicide Applications: Timing, Product Choice, Rates in Product Combination. June 19, 2015. http://www.mississippi-crops.com/2015/06/19/automatic-soybean-fungicide-applications-timing-product-choice-rates-in-product-combination/

Allen, T., and Irby, T. 2015. Soybean "Mystery Disease" Update. May 29, 2015. http://www.mississippi-crops.com/2015/05/29/soybean-mystery-disease-update/

Soybean educational radio interviews for Mississippi Ag Network (n=20):
Seed applied fungicide to get the season started off right. Mississippi Radio Network, April 23, 2015.

Soybean sentinel plot monitoring efforts and how they impact MS soybean farmers. Mississippi Radio Network, May 15, 2015.

Southern blight showing up in soybean, general disease update, soybean rust report. Mississippi Radio Network, May 23, 2014.

Fungicide resistance and soybean fungicide options for the 2015 season. Mississippi Radio Network, June 3, 2014.

Early-season soybean diseases: what to look for in the field. Mississippi Radio Network, June 12, 2015.

Fungicide active ingredients and making the proper fungicide selection. Mississippi Radio Network, June 14, 2015.

Choosing the proper seed applied fungicides in a double-crop situation. Mississippi Radio Network, June 20, 2014.

Should you apply a fungicide in a dryland situation as an automatic application? Mississippi Radio Network, July 2, 2014.

Septoria brown spot observations on the rise. Mississippi Radio Network, July 10, 2015.

Soybean nematode management alternatives and information regarding proper soil sampling techniques. Mississippi Radio Network, July 12, 2015.

Diseases of minor importance, such as downy mildew, in the MS soybean production system. Mississippi Radio Network, July 13, 2015.

Frogeye leaf spot update and fungicide management choices in situations where resistance has been observed. Mississippi Radio Network, July 27, 2015.

Soybean disease update with specific information regarding the soybean rust situation in MS and throughout the region. Mississippi Radio Network, August 12, 2014.

What do fungicide phytotoxicity observations from Mississippi soybean fields mean for farmers?. Mississippi Radio Network, August 14, 2015.

Soybean root diseases and how we can manage them. Mississippi Radio Network, August 22, 2015.

Soybean viruses observed throughout the Mississippi soybean production system during the 2015 season. Mississippi Radio Network, September 3, 2015.

Do late season soybean rust observations matter? Mississippi Radio Network, September 10, 2015.

Soybean disease wrap up. Mississippi Radio Network, September 17, 2015.

Managing nematodes and nematode sampling procedures. Mississippi Radio Network, September 23, 2015.

Stem canker screening program: selecting a resistant variety can help avoid yield loss. Mississippi Radio Network, October 1, 2015.

Proceedings (n=15):

Allen, T.W., Wilkerson, T.H., Irby, J.T., and Mansour, W.J. 2015. Fungicide-associated phytotoxicity: yield reducer or just plain aesthetics.

T.H. Wilkerson, M. Tomaso-Peterson, B.R. Golden, S. Lu, A.B. Johnson, and T.W. Allen. Investigating the reduction of *Macrophomina phaseolina* coloni-zation through addition of secondary nutrients.

N. Brochard, M.Tomaso-Peterson, T.W. Allen, and R. Melanson. Comparison of QoI resistant and sensitive isolates of the Frogeye Leaf Spot pathogen.

J. Mansour, M. Tomaso-Peterson, A. Henn, J. Bond, T. Irby, and T.W. Allen. 2015. Determining the impacts of fungicide phytotoxicity in Mississippi soybean.

Standish, J.R., Tomaso-Peterson, M., Allen, T.W., Sabanadzovic, S., and Aboughanem-Sabanadzovic, N. 2015. An investigation into QoI resistance in isolates of *Cercospora sojina* throughout Mississippi soybean production fields. Phytopathology 105(Suppl. 2):S2.10

Wilkerson, T., Tomaso-Peterson, M., Golden, B., Lu, S., Johnson, A.B., and Allen, T.W. 2015. Supression of charcoal rot in soybean caused by *Macrophomina phaseolina* using secondary nutrients. Phytopathology 105(Suppl. 2):S2.12.

T. Wilkerson, M. Tomaso-Peterson, B. R. Golden, S. Lu, A. B. Johnson, and T. W. Allen. 2015. Effect of secondary nutrient applications on suppression of charcoal rot in soybean.

N. Aboughanem-Sabanadzovic, S. Sabanadzovic, T. W. Allen, W. F. Moore, and R. C. Stephenson. 2015. Soybean vein necrosis virus in Mississippi.

J. R. Standish, M. Tomaso-Peterson, T. W. Allen, S. Sabanadzovic, and N. Aboughanem-Sabanadzovic. 2015. Investigating fungicide sensitivities beyond the QoIs in Cercospora sojina from Mississippi. 2015.

W. J. Mansour, J. T. Irby, B. R. Golden, T. H. Wilkerson, and T. W. Allen. 2015. Management of frogeye leaf spot and determining the impact of fungicide phytotoxicity in Mississippi soybean. 2015.

Poster: Aboughanem-Sabanadzovic, N., Moore, W. F., Allen, T.W., Stephenson, R.C., and Sabanadzovic, S. 2015. Soybean vein necrosis virus and other viruses in soybeans in Mississippi. Phytopathology 105(Suppl. 4):S4.3.

Poster: Mansour, W.J., Wilkerson, T.H., Irby, J.T., Golden, B.R., and Allen, T.W. 2015. Frogeye leaf spot management and the impact of fungicide phytotoxicity in Mississippi soybean. Phytopathology 105(Suppl. 4):S4.88.

Poster: Wilkerson, T., Tomaso-Peterson, M., Golden, B., Lu, S., Brown, A., and Allen, T. 2015. Examining the suppression of charcoal rot of soybean with secondary nutrients. Phytopathology 105(Suppl. 4):S4.148.

Poster: Brochard, N., Tomaso-Peterson, M., Allen, T., and Standish, J.R. 2015. Thiophate-methyl sensitivity of the frogeye leaf spot pathogen in Mississippi. Phytopathology 105(Suppl. 4):S4.20.

Golden, B.R., **Kakaire**, **S**., Allen, T.W., Fuhrman, M.D., Irby, T., Lofton, J., Neely, C.B.,

Ross, W.J., Schnell, R.W., Stevens, W., Hathcoat, D. and Rhine, M. 2015. Preliminary Nematode Survey from Soybean-Corn Rotations in the Mid-South U.S. In: Proceedings of the International Annual Meeting of the ASA, CSSA, SSSA and ESA, Minneapolis Convention Center, Minneapolis, MN, November 15-18, 2015. p.118.

Future plans for output(s) (n=1 refereed publication):

1) The 2012 season was the last year for the soybean rust hotline. I am in the process of drafting a manuscript regarding the connectedness of the telephone calls made to the hotline and how soybean rust information was disseminated. Much of this information can be used in presentations as well as included on the MSPB website once it has all been completed. However, it may be several months (likely 10-12) before this will be completed.

APPENDIX 2: Graphics/Tables

Figure 1. Map of scouted locations throughout MS that were relied on to gather important disease monitoring information. Red counties indicates a location where soybean rust was detected. During 2015, soybean rust was detected in all 82 counties (n = 44 total; n=43 soybean; n = 1 kudzu).