

VITA

William T. Schapaugh, Jr.

Discipline: Soybean Breeding and Genetics

Education: Ph.D., 1979, Purdue Univ., Plant Breeding, Genetics
M.S., 1977, Purdue Univ., Plant Breeding, Genetics
B.S., 1975, Iowa State Univ., Agronomy

Professional Positions:

Professor, Kansas State University Agronomy Department, 1989 to present
Interim Agronomy Department Head, April 2010 to July 2013
Associate Prof., Kansas State University Agronomy Department, 1983-1989
Assistant Prof., Kansas State University Agronomy Department, 1979-1982

Primary Research/Teaching Responsibilities: (90% Research, 10% Teaching)

Provide leadership to the soybean breeding and genetics program in Agronomy and Kansas State University. Develop and nurture cooperative programs with faculty in other departments, units, universities and the private sector to facilitate the development of new varieties and germplasm, and evaluate the usefulness of genetic diversity to address current goals. Offer a challenging graduate level applied plant breeding course. Facilitate the design, analysis and reporting of the Soybean Variety Performance Tests.

Professional Service

National: Reviewer for Crop Sci., Agron. J., J. Prod. Agric. and Kansas Academy of Sci. Editorial consultant for Kansas Academy of Science (1990-2000). ASA Membership Committee (Kansas Chair 1980-97), ASA Session Chair (1981, 85, 95), ASTA Soybean Research Planning Conference Chair (1986), ASTA Research Conference Chair (1987), National Soybean Breeders' Workshop Program Committee (1981, Co-chair 1982, 2003), National Soybean Breeders' Workshop Coordinator (1997-99), SoyCAP Representative (2004 to 2007). Soybean Genetics Committee (2007 to 2010), CSSA TE (2017 - present).

University: Graduate Council (1989-91), Graduate Council Advisory Committee (1989-91), Graduate Recertification Committee (1995-97), Faculty Senate (1992-94, 97-99, 2007- present), Faculty Senate Academic Affairs Committee (1992-94, Chair 1994), Admission and Enrollment Committee (1992), Education Experience Task Force (1993-94), Appendix O Review Committee (2006).

College Committees: Crop Variety Release (1984-2005), Course and Curriculum (1992-94), Scholarship (1994-98; Chair 1996-98), NCR-144 Representative (1992-95), Soybean Variety Release Board (1993-00), Eastern Research Locations (Chair 1995), Intellectual Property (1999-2000), Warren Scholarship (2004 to 2007), Faculty Evaluation (2006 to 2008).

Department Committees/Assignments: Course and Curriculum (1980-98), Graduate Student Club Advisor (1980-97), Graduate (1981-93, 97; Chair 1985-92, 97), Consultative Committee (1983-87), Experiment Field Liaison (1984-93), Heyne Lectureship (1984-2005; Chair 1985-91), Graduate Program Coordinator (1985-93), Scholarship (1990-92), Undergraduate Scholarship (Chair 1994-98), Graduate Scholarship (Chair 1994-2005), ASA Travel (1984-91), ASA Reception (1984-98; Chair 1993-95, 98), ASA Fellows and Nominations (1994-98), East Central Exp. Field (1991-2005), Kansas River Valley Exp. Field (1992-98), South-central Exp. Field (2001-04), Faculty Evaluation (1991-2005), Wheat State Agronomy Club Co-advisor (1996-98), CSRS Review Committee (1999-2000), Experiment Field Review Committee (1999), Department Head Advisory (1999-2003), Crop Performance Test Advisory (1994-2002), Agronomy Farm Advisory (1999-2004; Chair 2001-04), Foundation Seed Advisory (1999-2005, 2018), Farm operation committee (2015, Chair), South Central Exp. Field Committee (2010 -), Kansas River Valley Exp. Field Committee (2010 -), Space Committee (2018 -). Search Committees for: Alfalfa

Breeder (Chair), Canola Breeder (Chair), Powhattan Agronomist (Chair), Crop Performance Agronomist (Chair), North-central Agronomist, Southeast Agronomist, South-central Agronomist, Sorghum Breeder, Extension Agronomist, Agronomy Farm Manager, Department Head (Chair), Crop Performance Agronomist, Field Crop Plant Pathologist, Foundation Seed Manager (2016), Agronomy Farm Ag Tech (2016), South Central Assist Sci (2016), Soybean Breeding Ag Tech (Chair) (2017), Department Head (2019-2020). North Farm Master Planning (2021)

Extramural Funding: For the past 5 years, extramural funding specifically for the soybean breeding project in Agronomy has average over \$250K per year. The Kansas Soybean Commission has been the primary source of extramural funds since 1979. Additional funds have been received from the Kansas Crop Improvement Association, USDA, USB, NCSRP, DOE, private companies, and through fees.

Graduate Advising: A total of 14 and 25 students with the soybean breeding project have completed their Ph.D. or M.S. degrees, respectively.

Variety Releases: Since 1979, 38 conventional, 7 Roundup Ready® varieties have been released.

Refereed Publications:

1. Wilcox, J. R. and W. T. Schapaugh, Jr. 1978. Competition between two soybean isolines in hill plots. *Crop Sci.* 18:346-348.
2. Wilcox, J. R., W. T. Schapaugh, Jr. et al. 1979. Genetic improvement of soybeans in the midwest. *Crop Sci.* 19:803-805.
3. Schapaugh, Jr., W. T. and J. R. Wilcox. 1980. Relationship between harvest indices and other plant characteristics in soybeans. *Crop Sci.* 20:529-533.
4. Wilcox, J. R. and W. T. Schapaugh, Jr. 1980. Effectiveness of single plant selection during successive generation of inbreeding in soybeans. *Crop Sci.* 20:809-811.
5. Nickell, C. D., F. W. Schwenk, and W. T. Schapaugh, Jr. 1982. Registration of Douglas soybean. *Crop Sci.* 22:160.
6. Nickell, C. D., F. W. Schwenk, and W. T. Schapaugh, Jr. 1983. Registration of Sparks soybean. *Crop Sci.* 23:598.
7. Bouslama, M. and W. T. Schapaugh, Jr. 1984. Stress tolerance in soybean. I. Evaluation of three screening techniques for heat and drought tolerance. *Crop Sci.* 24:933-937.
8. Harris, D. S., W. T. Schapaugh, Jr. and E. T. Kanemasu. 1984. Genetic diversity in soybeans for leaf canopy temperature and the association of leaf canopy temperature and yield. *Crop Sci.* 24:839-842.
9. Burchett, C. A., W. T. Schapaugh, Jr., C. B. Overley, and T. L. Walter. 1985. Influence of etched seed coats and environmental conditions on soybean seed quality. *Crop Sci.* 25:655-660.
10. Ceron-Diaz, W. A., C. D. Nickell, and W. T. Schapaugh, Jr. 1986. Environmental effects on seed yield and other characteristics of irrigated soybeans differing in growth habits. *Trans. KAS* 89:23-30.
11. Ceron-Diaz, W. A., C. D. Nickell, and W. T. Schapaugh, Jr. 1987. Environmental effects on growth and development of irrigated soybeans with different growth habits. *Trans. KAS* 90:1-16.
12. Bowen, C. R. and W. T. Schapaugh, Jr. 1989. Relationships among charcoal rot infection, yield and stability estimates in soybean blends. *Crop Sci.* 29:42-46.
13. McKinney, N. V., W. T. Schapaugh, Jr., and E. T. Kanemasu. 1989. Selection for canopy temperature differential in six populations of soybean. *Crop Sci.* 29:255-259.
14. McKinney, N. V., W. T. Schapaugh, Jr., and E. T. Kanemasu. 1989. Canopy temperature, seed yield, and vapor pressure deficit relationships in soybean. *Crop Sci.* 29:1038-1041.
15. Izaurrealde, M. and W. T. Schapaugh, Jr. 1989. Influence of seed source on soybean

- productivity. *J. Appl. Seed Prod.* 6:20-26.
16. Coble, C. and W. T. Schapaugh, Jr. 1990. Factors affecting plant recovery of cultured embryos of three glycine genotypes and an inter-specific hybrid. *Euphytica* 50:127-133.
 17. Duncan, S., W. T. Schapaugh, Jr., and J. P. Shroyer. 1990. Relay intercropping soybeans into wheat in Kansas. *J. Prod. Agric.* 3:576-581.
 18. Duncan, S.R. and W.T. Schapaugh, Jr. 1993. Row orientation and planting pattern of relay intercropped soybean and wheat. *J. of Prod. Ag.* 6:360-364.
 19. Serretti, C., W.T. Schapaugh, Jr. and R.C. Leffel. 1994. Amino acid profile of high-seed-protein soybean. *Crop Sci.* 34: 207-209.
 20. Scott, R.A., M.C. Champoux, and W.T. Schapaugh. 1994. Influence of environmental productivity levels and yield stability on selection strategies in soybean. *Euphytica* 78:115-122.
 21. Loughin, T.M., D.F. Cox, P.N. Hinz, W.T. Schapaugh, and L. Kilgore-Norquest. 1995. Experimental error in agronomic field trials. In *Applied Statistics in Agriculture. Proc. Applied Statistics in Agriculture*, Kansas State University, Manhattan, KS. April 25-27, 1994.
 22. Todd, T.C., W.T. Schapaugh, Jr., J.H. Long and B. Holmes. 1996. Field response of soybean in maturity groups III-V to *Heterodera glycines* in Kansas. Supplement to *J. of Nematology* 27:628-633.
 23. Glover, D.G., and W.T. Schapaugh, Jr. 1997. Screening of soybean for pendimethalin herbicide induced stem damage. *Crop Sci.* 37:358-360.
 24. Yue, G.L., K.L. Roozeboom, W.T. Schapaugh, and G.H. Liang. 1997. Evaluation of soybean cultivars using parametric and nonparametric stability estimates. *Plant Breeding* 116:271-275.
 25. Duncan, S.R., and W.T. Schapaugh, Jr. 1997. Relay-intercropped soybean in different water regimes, planting patterns, and winter wheat cultivars. *J. Prod. Agric.* 10:123-129.
 26. Schapaugh, W.T. and R.E. Dille. 1998. Registration of 'KS4694'. *Crop Sci.* 38:891.
 27. Schapaugh, W.T. and R.E. Dille. 1998. Registration of 'KS4895'. *Crop Sci.* 38:892.
 28. Schapaugh, W.T. 1998. Registration of 'KS3494'. *Crop Sci.* 38:891.
 29. Schapaugh, W.T. and T.C. Todd. 1998. Registration of 'KS5292'. *Crop Sci.* 38:890.
 30. Schapaugh, W.T., P.A. Owen. K.M. Clark, and D.A. Slepser. 1998. Registration of 'Magellan'. *Crop Sci.* 38:892.
 31. Aziadekey, M., W.T. Schapaugh, Jr. and T.J. Herald. 2002. Genotype by environment interaction for soymilk and tofu quality characteristics. *J. of Food Qual.* 25: 243-259.
 32. Glover, D.G. and W.T. Schapaugh, Jr. 2002. Inheritance of resistance to pendimethalin herbicide induced stem damage in soybean. *Euphytica* 125:433-437.
 33. Khatib, K.A., T.J. Herald, F.M. Aramouni, F. MacRitchie and W.T. Schapaugh. 2002. Characterization and functional properties of soy B-conglycinin and glycinin of selected genotypes. *J. of Food Sci.* 67: 2923-2929.
 34. Meis, S.J., W.T. Schapaugh, Jr. and G.A. Milliken. 2002. Relative performance of soybean in end-trimmed and plant-to-length plots. *Crop Sci.* 42: 700-704.
 35. Wang, D., F.E. Dowell, M.S. Ram, and W.T. Schapaugh. 2003. Classification of fungal-damaged soybean seeds using near-infrared spectroscopy. *Int. J. of Food Properties* 6:1-8.
 36. Wang, D., F.E. Dowell, M.S. Ram, and W.T. Schapaugh. 2003. Classification of fungal-damaged soybean seeds using near-infrared spectroscopy. *Int. J. of Food Properties* 6:1-8.
 37. Ornatowski, W., J. Jayaraj, T.C. Todd, W.T. Schapaugh, S. Muthukrishnan and H.N. Trick. 2004. Introduction and constitutive expression of a tobacco hornworm chitinase gene in soybean. *Vitro Cell. Dev. Biol.* 40(3):260-265.
 38. Swanson, M., M. Stoll, W. Schapaugh, and L. Takemoto. 2004. Isoflavone content of Kansas soybeans. *Am. J. of Undergrad. Res.* 2: 27-32.
 39. Lingenfelter, J.E., W.T. Schapaugh, Jr., J.P. Schmidt and J.J. Higgins. 2005. Comparison of

- genotype and cultural practices to control iron deficiency chlorosis in soybean. *Comm. In Soil Sci. and Plant Analysis* 36: 1047-1062.
40. Diaz-Montano, J., J.C. Reese, W.T. Schapaugh, and L.R. Campbell. 2006. Characterization of antibiosis and antixenosis to the soybean aphid in several soybean genotypes. *J. of Econ. Entomology* 99:1884-1889.
 41. Stoll, M.E., W.T. Schapaugh, Jr., M.S.Zutara, J.Hu and X.S. Sun. 2006. Genotype and environmental effects on adhesive shear strength in soybean-based adhesives. *Crop Sci.* 46:2008-2012 (Contribution number 06-9-S).
 42. Diaz-Montano, J., J.C. Reese, W.T. Schapaugh, and L.R. Campbell. 2007. Chlorophyll loss caused by soybean aphid feeding on soybean. *J. of Econ. Entomology* 100:1657-1662.
 43. Diaz-Montano, J., J.C. Reese, J. Louis, L.R. Campbell and W.T. Schapaugh. 2007. Feeding behavior by the soybean aphid on resistant and susceptible soybean genotypes. *J. of Econ. Entomology* 100:984-989.
 44. Roozeboom, K.L, William T. Schapaugh, Mitchell R. Tuinstra, Richard L. Vanderlip, and George A. Milliken. 2008. Testing Wheat in Variable Environments: Genotype, Environment, Interaction Effects and Grouping Test Locations. *Crop Sci.* 48: 317-330.
 45. Schapaugh Jr., W.T., T. Todd, J. Reese, J. Diaz-Montano, J. Meng, and C.M. Smith. 2010. Registration of K1639-2 soybean germplasm resistant to soybean cyst nematode and soybean aphid. *J. of Plant Registrations* 4:1-3.
 46. T.C. Helms, T.C., R. A. Scott, W.T. Schapaugh, R.J. Goos, D.W. Franzen, and A.J. Schlegel. 2010. Soybean iron-deficiency chlorosis tolerance and yield decrease on calcareous soils. *Agron. J.* 102: 492-498.
 47. Lee, J., Welti, R., Schapaugh, W.T., and Trick, H.N. 2010. Phospholipid and triacylglycerol profiles modified by *PLD* suppression in soybean seed. *Plant Biotechnology Journal* (online) 1-14 doi: 10.1111/j.1467-7652.2010.00562.x (KAES no. 10-294-J).
 48. Djanaguiraman, P. V. V. Prasad, D. L. Boyle and W. T. Schapaugh. 2011. High-Temperature Stress and Soybean Leaves: Leaf Anatomy and Photosynthesis. *Crop Sci.* 51: 2125-2131.
 49. Junghoon Lee, Ruth Welti, Mary Roth, William T. Schapaugh, Jiarui Li and Harold N. Trick. 2012. Enhanced seed viability and lipid compositional changes during natural ageing by suppressing phospholipase Da in soybean seed. *Plant Biotechnology Journal*, 164–173.
 50. T. Niide, R. A. Higgins, R. J. Whitworth, W. T. Schapaugh, C. M. Smith and L. L. Buschman. 2012. Antibiosis Resistance in Soybean Plant Introductions to *Dectes texanus*. *J. Econ. Ent.* 105: 598-607.
 51. Djanaguiraman, P. V. V. Prasad, D. L. Boyle and W. T. Schapaugh. 2013. Soybean Pollen Anatomy, Viability and Pod Set under High Temperature Stress. *J. Agron. Crop Sci.* 199: 171-177.
 52. Djanaguiraman, P.V.V. Prasad, and W.T. Schapaugh. 2013. High day or nighttime temperature alters leaf assimilation, reproductive success and phosphatidic acid of pollen grain in soybean. *Crop Sci.* 53:1594-1604.
 53. Abdel-Haleem, H., T. Carter, L. Purcell, C. King, L. Ries, P. Chen, W. Schapaugh, T. Sinclair and H. Boerma. 2012. Mapping of quantitative trait loci for canopy-wilting trait in soybean. *Theoretical and Applied Genetics* 125: 837-846.
 54. Rincker, K., R. Nelson, J. Specht, D. Sleper, T. Cary, S.R. Cianzo, S. Casteel, S. Conley, P. Chen, V. Davis, C. Fox, G. Graef, C. Godsey, D. Holshouser, Guo-Liang Jiang, S.K. Kantartzi, W. Kenworthy, C. Lee, R. Mian, L. McHale, S. Naeve, J. Orf, V. Poysa, W. Schapaugh, G. Shannon, R. Uniatowski, D. Wang, and Brian Diers. 2014. Genetic improvement of U.S. soybean in maturity groups II, III, and IV. *Crop Sci.* 54:1-14.
 55. L.F. Brzostowski, W.T. Schapaugh, P.A. Rzedkiewicz, T.C. Todd and C.R. Little. 2014. Effect of host resistance to *Fusarium virguliforme* and *Heterodera glycines* on sudden death

- syndrome disease severity and soybean yield. *Plant Health Progress* doi:10.1094/PHP-RS-13-0100.
56. Chandran, P., Reese, J. C., Khan, S. A., Wang, D., Schapaugh, W., & Campbell, L. R. 2013. Feeding behavior comparison of soybean aphid (hemiptera: Aphididae) biotypes on different soybean genotypes. *Journal of Economic Entomology*, 106(5), 2234-2240.
 57. Brent S. Christenson, William T. Schapaugh, Jr., Nan An, Kevin P. Price, and Allan K. Fritz. 2014. Characterizing Changes in Soybean Spectral Response Curves with Breeding Advancements. *Crop Sci.* 54:1585–1597.
 58. S. M. Pathan, J.-D. Lee, D. A. Sleper, F. B. Fritschi, R. E. Sharp, T. E. Carter, R. L. Nelson, C. A. King, W. T. Schapaugh, M. R. Ellersieck, H. T. Nguyen, J. G. Shannon. 2014. Two Soybean Plant Introductions Display Slow Leaf Wilting and Reduced Yield Loss under Drought. *Journal of Agronomy and Crop Science* DOI: 10.1111/jac.12053.
 59. Sadal Hwang, C. Andy King, Jeffery D. Ray, Perry B. Cregan, Pengyin Chen, Thomas E. Carter Jr., Zenglu Li, Hussein Abdel-Haleem, Kevin W. Matson, William Schapaugh Jr., and Larry C. Purcell. 2015. Confirmation of delayed canopy wilting QTLs from multiple soybean mapping populations. *Theor. Appl. Genet.* 128:2047–2065.
 60. Keep, N.R., W.T. Schapaugh, Jr., P.V.V. Prasad, and J.E. Boyer, Jr. 2016. Changes in physiological traits in soybean with breeding advancements. *Crop Sci.* 56: 122-131.
 61. Christenson, B., W.T. Schapaugh, N. An, K. Price, and Allan Fritz. 2016. Predicting soybean relative maturity and seed yield using canopy reflectance. *Crop Sci.* 625-643.
 62. Sadal Hwang. C. Andy King. Pengyin Chen. Jeffery D. Ray. Perry B. Cregan, Thomas E. Carter Jr., Zenglu Li. Hussein Abdel-Haleem. Kevin W. Matson, William Schapaugh Jr., and Larry C. Purcell. 2016. Meta-analysis to refine map position and reduce confidence intervals for delayed-canopy-wilting QTLs in soybean. *Mol. Breeding* DOI 10.1007/s11032-016-0516-5.
 63. Xavier A., D. Jarquin, R. Howard, V. Ramasubramanian, J.E. Specht, G.L. Graef, W.D. Beavis, B.W. Diers, Q. Song, P. Cregan, R. Nelson, R. Mian, J.G. Shannon, L. McHale, D. Wang, W. Schapaugh, A.J. Lorenz, S. Xu, W.M. Muir, K.M. Rainey. 2017. Genome-wide analysis of grain yield stability and environmental interactions in a multi-parental soybean population. *Genes|Genomes|Genetics* DOI:10.1534/g3.117.300300.
 64. Kaler, S., J.D. Ray, W.T. Schapaugh, C.A. King, and L.C. Purcell. 2017. Genome-wide association mapping of canopy wilting in diverse soybean genotypes. *Theor. Appl. Genet.* 130:2203–2217. DOI 10.1007/s00122-017-2951-z.
 65. Avjinder S. Kaler, Jeffery D. Ray, William T. Schapaugh, Antonio R. Asebedo, C. Andy King, E. E. Gbur, and Larry C. Purcell. 2018. Association mapping identifies loci for canopy temperature under drought in diverse soybean genotypes. *Euphytica* 214:135.
 66. Diers B.W., Specht J., Rainey K.M., Cregan P., Song Q., Ramasubramanian V., Graef G., Nelson R., Schapaugh W., Wang D., Shannon G., Mchale L., Kantartzi S.K., Xavier A., Mian R., Stupar R.M., Michno J.-M., An Y.-Q.C., Goettel W., Ward R., Fox C., Lipka A.E., Hyten D., Cary T., Beavis W.D. 2018. Genetic architecture of soybean yield and agronomic traits. *G3* 8: 3367-3375.
 67. Ye H, Song L, Schapaugh WT, Ali MDL, Sinclair TR, Riar MK, Raymond RN, Li Y, Vuong T, Valliyodan B, Neto PA, Klepadlo M, Song Q, Shannon JG, Chen P, Nguyen HT. 2019. The importance of slow canopy wilting in drought tolerance in soybean, *Journal of Experimental Botany* 71, 642–652.
 68. Djanaguiraman M., Schapaugh W., Fritschi F., Nguyen H., Prasad P.V.V. 2019. Reproductive success of soybean (*Glycine max* L. Merr.) cultivars and exotic lines under high daytime temperature. *Plant Cell and Environment*: 42: 321-336.
 69. Nicholle Hatton, Ajay Sharda, William Schapaugh, Deon van der Merwe. 2020. Remote thermal infrared imaging for rapid screening of sudden death syndrome in soybean.

Computers and Electronics in Agriculture, Volume 178, 105738, ISSN 0168-1699, <https://doi.org/10.1016/j.compag.2020.105738>.

70. Clinton J. Steketee, William T. Schapaugh, Thomas E. Carter and Zenglu Li. 2020. Genome-wide association analyses reveal genomic regions controlling canopy wilting in soybean. *G3: GENES, GENOMES, GENETICS* Vol. 10 no. 4 1413-1425; <https://doi.org/10.1534/g3.119.401016>.
 71. Lina M. Aguirre-Rojas, Lawrent L. Buschman, Brian McCornack, William T. Schapaugh, Erin D. Scully, Kun Yan Zhu, Harold N. Trick, and Charles Michael Smith. 2021. Inheritance of antibiosis resistance to the Dectes Stem Borer, *Dectes texanus*, in soybean PI165673. *Agronomy* 11: 738. <https://doi.org/10.3390/agronomy11040738>.
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