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**APPOINTMENT:** Extension (80%); Academic (20%)

## **EDUCATION**

- **Doctor of Philosophy** (Biological Systems Engineering), August 2000, Virginia Tech, Blacksburg, VA
- **Master of Science** (Biological and Agricultural Engineering), July 1995, Louisiana State University, Baton Rouge, LA
- **Bachelor of Technology** (Agricultural Engineering), *summa cum laude*, Punjab Agricultural University, Ludhiana, India

## **PROFESSIONAL EXPERIENCE**

- **Associate Professor and Extension Specialist** (August 2009-present), Biological and Agricultural Engineering (BAE) Dept., NCSU, Raleigh, NC
  - Provide extension and outreach support to stakeholders through the NC Cooperative Extension Service in the area of animal waste management, particularly poultry litter management and air quality; conduct applied research in the areas of animal waste air and water qualities; teach undergraduate and graduate level courses
- **Assistant Professor and Extension Specialist** (August 2003-present), BAE Dept., NCSU, Raleigh, NC
  - As above
- **Assistant Professor and Extension Specialist** (August 2000-July 2003), West Virginia University Extension Service, Morgantown, WV
  - Provided extension and outreach support to West Virginia stakeholders on agricultural engineering aspects; conducted applied research on animal waste management; taught two senior/graduate level courses annually
- **Graduate Research Assistant** (August 1995-August 2000), Biological Systems Engineering (BSE) Dept., Virginia Tech, Blacksburg, VA

- Evaluated impact of urea pellets versus urea granules on corn silage yield and nitrate leaching using field and laboratory experiments; developed and tested mathematical model for simulating two-dimensional nitrogen transport from band-applied urea granules and pellets; taught or assisted in teaching irrigation and water management, sanitation, and instrumentation; member of BSE team that developed Total Maximum Daily Load (TMDL) plans for fecal coliform for four impaired stream segments in Virginia
- **Graduate Research Assistant** (January 1994-July 1995), Biological and Agricultural Engineering Dept., LSU, Baton Rouge, LA
  - Conducted field and laboratory studies to quantify daily evapotranspiration (ET) requirement of flooded rice for thesis research; evaluated various mathematical ET models for their ability to predict rice ET; taught hydrology and surveying classes
- **Head of Dept. (production and R & D), research engineer, production engineer** (August 1985-December 1994), Agricultural Tools Factory Ltd., Birganj, Nepal
  - Supervised agricultural machinery production; developed wide variety of agricultural machinery, including seeding, planting, and fertilizing equipment; conducted extension; performed managerial and administrative duties

## **HONORS/AFFILIATIONS**

Special Specialist Award, 2009

Robert W. Bottcher Promising Researcher Award, 2006

Faculty Research and Professional Development Award, NCSU, 2004

WVU Extension Service Outstanding Developing Researcher Award, 2002

Member, ASAE - 1995-present

Member, Soil and Water Conservation Society (SWCS), 1998-present

Alpha Epsilon, 1996-2000

Gamma Sigma Delta, 1998-2000

PAU Gold Medal - Academic performance at the Bachelor's Level, 1985

USAID Scholarship, India, 1980-1985

## **GRANTS FUNDED**

1. **Retrofitting a naturally-ventilated hog finishing barn with a geothermal zone-cooling system**, PI, \$24,972 (NC Pork Council, NCPC), 2012

- 2. Solar ducts for reducing propane use and improving air quality in pig nursery and turkey brooder house, PI, \$75,000 (USDA-NRCS Conservation Innovation Grant), 2010-2013**
- 3. Poultry litter BMP extension & subsurface application technology evaluation, co-PI, \$50,588 (USDA-NRCS Conservation Innovation Grant), 2010-2012**
- 4. Coordinated analysis to facilitate technology transfer to meet emission requirements for next generation livestock and poultry production facilities, co-PI, \$325,368 (USDA-CSREES-SRGP), 2009-2011**
- 5. Retrofitting a pig nursery with a transpired solar wall to save heat energy and improve pig performance, PI, \$25,000 (NC Pork Council), 2008-2009**
- 6. Poultry and livestock air quality research initiative, co-PI, \$451,944 (USDA-CSREES-SRGP), 2006-2009**
- 7. Litter amendment and improved diet impacts on broiler ammonia emissions and productivity, PI, \$499,754 (USDA - NRI), 2006-2009**
- 8. Comparing environmental impacts and agronomic performance of a subsurface drip irrigation system and a traditional spray system used for land application of animal waste, co-PI, \$32,749 (NCSU - Animal and Poultry Waste Management Center), 2006-2008**
- 9. Determining plant-available nitrogen in hog anaerobic lagoon effluent applied with traveling gun and drag hose systems, PI, \$30,000 (WVRI), 2005-2006**
- 10. A regenerating scrubber for reducing animal house emissions, PI, \$21,900 (NCSU - Animal and Poultry Waste Management Center), 2004-2006**
- 11. Arsenic and heavy metal leaching potential from broiler litter stockpiled on bare soil, PI, \$50,000 (WVRI), 2004-2005**
- 12. An improved wind tunnel to measure ammonia volatilization from land and lagoon surfaces, PI, \$4,000 (NCSU Res. & Grad. Studies), 2004-2005**
- 13. Conserving energy in a poultry house by recirculating air through a biofilter to harvest ammonia, PI, \$209,323 (US Dept. of Energy through the WV Development Office's Energy Efficiency Program and Pilgrim's Pride), 2004-2007**
- 14. Agronomic and environmental impacts of mechanical aeration of grassland, PI, \$19,850 (WVU Res. Corp.), 2002-2003**
- 15. Developing a machine for applying poultry litter in subsurface bands in the soil, PI, \$14,934 (WVU Senate), 2002-2003**
- 16. Evaluating the environmental impacts of different poultry litter application methods, PI, \$9,522 (WVU), 2002**
- 17. West Virginia AgrAbility Project, Collaborator, \$270,000 (USDA), 2001-2003**

18. **Treatment of milkhouse and parlor washwater using a bench-scale wheat straw biofilter**, PI, \$6,600 (WVU), 2001
19. **Heat and ammonia recovery from poultry house exhaust: evaluation of two bench-scale systems**, PI, \$4,700 (WVU), 2001

## REFEREED PUBLICATIONS

1. **Shah, S.B.**, H. Yao, and J.A. Osborne. 2013. Storage method impacts on ammonia flux from broiler cake and acid scrubbers for high ammonia concentration measurements. *Water Air Soil Pollut.* **(Accepted)**
2. Love, C., **S.B. Shah\***, J. Grimes, & D. Willits. 2013. Transpired solar collector duct for tempering air in North Carolina turkey brooder barn and swine nursery. *Solar Energy* **(Accepted)**
3. **Shah, S.B.**, E. O. Oviedo-Rondón, J.L. Grimes, P.W. Westerman, & D. Campeau. 2013. Acidifier dosage effects on inside ammonia concentrations in roaster houses. *Appl. Eng. Agric.* 29:573-580.
4. Liang, W., J.J. Classen, **S.B. Shah**, and R. Sharma-Shivappa. Ammonia fate and transport mechanisms in broiler litter. *Water Air Soil Pollut.* **(Accepted)**
5. Li, Q.-F., L. Wang-Li, **S.B. Shah**, R.K.M. Jayanty, and P. Bloomfield. 2013. Ammonia concentrations and modeling of inorganic particulate matter in the vicinity of an egg production facility in Southeastern U.S. *Environ. Sci. Pollut. Res.* **(Accepted)**
6. Oviedo-Rondón, E.O, **S.B. Shah**, J.L. Grimes, P.W. Westerman, and D. Campeau. Live performance of roasters raised in houses receiving different acidifier application rates. *J. Appl. Poult. Res.* **(Accepted)**
7. **Shah, S.B.**, J.L. Grimes, E. Oviedo-Rondón, and P.W. Westerman. 2013. Acidifier application rate impacts on ammonia emissions from US roaster chicken houses. *Atmos. Environ.* <http://dx.doi.org/10.1016/j.atmosenv.2013.01.044>
8. Liang, W., **S.B. Shah\***, J.J. Classen, and R. Sharma-Shivappa. 2013. Modeling ammonium adsorption on broiler litter and cake. *Water Air Soil Pollution* 224: Article 1405
9. **Shah, S.B.**, J.L. Grimes, E.O. Oviedo-Rondón, P.W. Westerman, and D. Campeau. 2013. Nitrogen mass balance in commercial roaster houses receiving different acidifier application rates. *J. Appl. Poult. Res.* 22:539-550.
10. **Shah, S.B.**, P.W. Westerman, J. L. Grimes, E.O. Oviedo-Rondón, and D. Campeau. 2013. Ancillary impacts of different acidifier application rates in roaster houses. *J. Appl. Poult. Res.* 22:565-573.
11. Li, Q.-F., L. Wang-Li, R.K.M. Jayanty, and **S.B. Shah**. 2013. Organic and elemental carbon in atmospheric fine particulate in an animal agriculture intensive area in North Carolina: estimation of secondary organic carbon concentrations. *Open J. Air Pollut.* **(Accepted)**
12. Li, Q.-F., L. Wang-Li, J.T. Walker, **S.B. Shah**, P. Bloomfield, and R.K.M. Jayanty. 2012. Particulate matter in the vicinity of an egg production facility: concentrations, statistical distributions, and upwind and downwind comparison. *Trans. ASABE* 55:1965-1973.
13. **Shah, S.B.** and P. Kolar. 2012. Evaluation of additive for reducing gaseous emissions from swine waste. *CIGR Journal* 14:10-20.

14. Kolar, P., **S.B. Shah\***, and C. Love. 2012. Feasibility of extracting ammonia from broiler litter and scale-up considerations. *Appl. Eng. Agric.* 28:577-582.
15. Li, Q-F., L. Wang-Li, **S.B. Shah**, R.K.M. Jayanty, and P. Bloomfield. 2011. Fine particulate matter in a high-rise layer house and its vicinity. *Trans. ASABE* 54:2299-2310.
16. **Shah, S.B.**, D.J. Workman, J. Yates, T.J. Basden, C.T. Merriner, and J. deGraft-Hanson. 2011. Coupled biofilter – heat exchanger prototype for a broiler house. *Appl. Eng. Agric.* 27:1039-1048.
17. Yao, H., **S.B. Shah\***, D.H. Willits, P.W. Westerman, L. Wang Li, and T.K. Marshall. 2011. Ammonia emissions from broiler cake stockpiled in a naturally ventilated shed. *Trans. ASABE* 54:1893-1904.
18. Liu, Z., L. Wang-Li, L., D.B. Beasley, and **S.B. Shah**. 2011. Validation and uncertainty analysis of an ammonia emission model for broiler litter. *Trans. ASABE* 54:1051-1057.
19. **Shah, S.B.**, K.J. Hutchison, D.L. Hesterberg, G.L. Grabow, R.L. Huffman, D.H. Hardy, and J.T. Parsons. 2009. Leaching of nutrients and trace elements from stockpiled turkey litter. *J. Environ. Qual.* 38:1053-1065.
20. **Shah, S.B.**, B.K. Balla, G.L. Grabow, P.W. Westerman, and D.E. Bailey. 2009. Impact of land application method on ammonia loss from hog lagoon effluent. *Appl. Eng. Agric.* 25: 963-973.
21. Liu, Z., L. Wang, D.B. Beasley, and **S.B. Shah**. 2009. Modeling ammonia emission from broiler litter at laboratory scale. *Trans. ASABE* 52:1683-1694.
22. **Shah, S.B.**, P.W. Westerman, R.D. Munilla, M.E. Adcock, and G.R. Baughman. 2008. Design and evaluation of a regenerating scrubber for reducing animal house emissions. *Trans. ASABE* 41(1):243-250.
23. **Shah, S.B.**, C.L. Baird, and J.M. Rice. 2006. Impact of a metabolic stimulant on ammonia volatilization from broiler litter. *J. Appl. Poult. Res.* 16(2):240-247.
24. **Shah, S.B.**, G.L. Grabow, and P.W. Westerman. 2006. Ammonia adsorption in five types of flexible tubing materials. *Appl. Eng. Agric.* 22(6):919-923.
25. **Shah, S.B.**, P.W. Westerman, and J. Arogo. 2006. Measuring ammonia concentrations and emissions from agricultural land and liquid surfaces: a review. *J. Air .Waste Manage. Assoc.* 56(7):945-960.
26. Zeckowski, R. W., B.L. Benham, **S.B. Shah**, M.L. Wolfe, K.M. Brannan, M. Al-Smadi, T.A. Dillaha, S. Mostaghimi, and C.D Heatwole. 2005. BSLC: a source for bacterial source characterization for watershed management. *Appl. Eng. Agric.* 21(5):879-889.
27. **Shah, S.B.**, M.L. Wolfe, and J.T. Borggaard. 2004. Simulating the fate of subsurface-banded synthetic nitrogen. *Nut. Cycl. Agroecosys.* 70(1):47-66.
28. **Shah, S.B.**, J.L. Miller, and T.J. Basden. 2004. Mechanical aeration and liquid dairy manure application impacts on grassland runoff water quality and yield. *Trans. ASAE* 47(3):777-788.
29. **Shah, S. B.**, M.D. Shamblin, H.N. Boone, S.A. Gartin, and D.K. Bhumbla. 2004. Runoff water quality impacts of different turkey litter application methods. *Appl. Eng. Agric.* 20(2):207-210.
30. **Shah, S.B.** and M.L. Wolfe. 2003. Particle size impacts of subsurface-banded urea on nitrogen transformation in the laboratory. *Commun. Soil Sci. Plant Anal.* 34(9&10):1245-1260.
31. **Shah, S. B.**, T.J. Basden, and D.K. Bhumbla. 2002. Bench-scale biofilter for removing ammonia from poultry house exhaust. *J. Environ. Sci. Health B38(1):89-102.*

32. **Shah, S. B.**, D.K. Bhumbra, T.J. Basden, and L.L. Lawrence. 2002. Cool temperature performance of a wheat straw biofilter for treating dairy wastewater. *J. Environ. Sci. Health* B37(5):493-505.
33. **Shah, S. B.** and M. L. Wolfe. 2002. Nitrate leaching impact of urea pellets versus granules. *Appl. Eng. Agric.* 18(1):57-64.
34. **Shah, S. B.** and R. J. Edling. 2000. Daily evapotranspiration prediction from a Louisiana flooded rice field. *J. Irrig. Drain. Eng.* 126(1):8-13.

\*Corresponding author

## **REPORTS**

1. **Shah, S. B.**, G. L. Grabow, R. L. Huffman, D. L. Hesterberg, D. H. Hardy, K. J. Hutchison, and J. Parsons. 2006. Arsenic and heavy metal leaching potential from turkey litter stockpiled on bare soil. Draft Report submitted to the UNC Water Resources Research Institute.
2. Al-Smadi, M., K. M. Brannan, T. A. Dillaha, C. D. Heatwole, J. Miller, S. Mostaghimi, **S. B. Shah**, and M. L. Wolfe (In alphabetical order). 2000. Fecal Coliform TMDL for Sheep Creek, Elk Creek, Machine Creek, Little Otter River, and Big Otter River, Bedford and Campbell Counties, Virginia. Final Report for Virginia Dept. of Conservation and Recreation (VDCR), Division of Soil and Water Conservation (DSWC).
3. Al-Smadi, M., K. M. Brannan, R. Currie, D. Cherry, T. A. Dillaha, C. D. Heatwole, J. Miller, S. Mostaghimi, **S. B. Shah**, and M. L. Wolfe (In alphabetical order). 2000. Fecal Coliform TMDL for Dry River, Rockingham County, Virginia. Final Report for VDCR, DSWC.
4. Al-Smadi, M., K. M. Brannan, R. Currie, D. Cherry, T. A. Dillaha, C. D. Heatwole, J. Miller, S. Mostaghimi, **S. B. Shah**, and M. L. Wolfe (In alphabetical order). 2000. Fecal Coliform TMDL for Mill Creek, Rockingham County, Virginia. Final Report for VDCR, DSWC.
5. Al-Smadi, M., K. M. Brannan, R. Currie, D. Cherry, T. A. Dillaha, C. D. Heatwole, J. Miller, S. Mostaghimi, **S. B. Shah**, and M. L. Wolfe (In alphabetical order). 2000. Fecal Coliform TMDL for Pleasant Run, Rockingham County, Virginia. Final Report for VDCR, DSWC.
6. **Shah, S. B.** and B. B. Karki. 1989. Effects of farm mechanization on rural employment in Chitwan district of Nepal. Los Banos, Philippines: RNAM.

## **EXTENSION, POPULAR, AND NON-REFEREED PUBLICATIONS**

1. **Shah, S.B.**, P.W. Westerman, and G.L. Grabow. 2007. Additives for improving hog farm air quality. Bulletin Ag-686W/EO750245, North Carolina Cooperative Extension Service.
2. **Shah, S.B.** and L.M. Risse. 2006. EPA proposes to revise deadlines for National Pollution Discharge Elimination System (NPDES) and Effluent

Limitation Guidelines (ELG) for CAFOs. Southern Animal Manure and Waste Management Quarterly E-newsletter, March 2006.

3. **Shah, S.B.**, P.W. Westerman, and J. Parsons. 2006. Poultry litter amendments. Bulletin Ag-57-s (short version) and Ag-57-1 (long version), North Carolina Cooperative Extension Service.
4. Grabow, G., K. Shaffer and **S. Shah**. 2005. Hose Drag Systems for Land Application of Liquid Manure and Wastewater. Bulletin Ag-634, North Carolina Cooperative Extension Service.
5. **Shah, S. B.**, H. W. Hogmire, R. K. Zimmerman, and B. B. Ross. 2002. Irrigation resources and training needs of fruit growers in Eastern Panhandle of West Virginia and Shenandoah valley of Virginia. *The Mountaineer Grower*, Oct.-Dec. 2002.
6. **Shah, S. B.** and R. Chandran. February 2002. Nonchemical measures can reduce lady beetles indoors. WV Farm Bureau News (also published as fact sheet)
7. **Shah, S. B.** May 2001. Pesticide storage, mixing, and disposal. WVU Extension Service. Factsheet

## PRESENTATIONS

1. **Shah, S.B.**, P.W. Westerman, R. Munilla and G. Baughman. 2007. Performance evaluation of a regenerating scrubber for animal house emissions. International symposium on air quality and waste management for agriculture (Broomfield, CO). Publication No. 701P0907cd. St. Joseph, MI: ASABE.
2. **Shah, S.B.**, T.K. Marshall, E.P. Harris, P.W. Westerman, and R.D. Munilla. 2007. An innovative wind tunnel for evaluating gaseous emissions from agricultural land or liquid surfaces. 2007 ASABE international meeting. Paper No. 074005. St. Joseph, MI: ASABE.
3. **Shah, S.B.**, T. Basden, D. Workman, J. Yates, C. Merriner, and J. deGraft-Hanson. 2007. A biofilter-heat exchanger system for reducing ammonia emissions from and energy use in a broiler house. 2007 ASABE international meeting. Paper No. 074136. St. Joseph, MI: ASABE.
4. **Shah, S.B.**, B.K. Balla, G.L. Grabow, P. W. Westerman, and D. Bailey. 2006. Measuring ammonia emissions from hog anaerobic lagoon effluent applied with traveling gun and drag hose systems. 2006 ASABE international meeting. Poster No. 064071. St. Joseph, MI: ASABE.
5. **Shah, S.B.**, P. W. Westerman, R. Munilla and G. Baughman. 2006. A regenerating scrubber for reducing animal house emissions. 2006 ASABE international meeting. Poster No. 064041. St. Joseph, MI: ASABE.

6. **Shah, S.B.**, G.L. Grabow, R.L. Huffman, D.L. Hesterberg, K.J. Hutchison, J. Parsons, D.H. Hardy, and B. Jackson. 2005. Leaching of arsenic and other pollutants from turkey litter stockpiled on bare soil: preliminary results. 2005 ASAE international meeting. Poster No. 054076.
7. R. Zeckoski, S. Mostaghimi, K. Brannan, B. Benham, T. Dillaha, C. Heatwole, **S. B. Shah**, R. Wagner, M. L. Wolfe, J. Wynn, and G. Yagow. 2003. A program for generating fecal coliform inputs to HSPF. Conference Proceedings of the Total Maximum Daily Load (TMDL) Environmental Regulations-II (Albuquerque, NM), pp 001-006. St. Joseph, MI: ASAE.
8. **Shah, S. B.**, M. D. Shamblin, H. N. Boone, S. A. Gartin, and D. K. Bhumbra. 2003. Environmental impacts of different turkey litter application methods. 2003 ASAE international meeting. Paper No. 032153. St. Joseph, MI: ASAE.
9. Brannan, K. M., S. Mostaghimi, T. A. Dillaha, C. D. Heatwole, M. L. Wolfe, M. Al-Smadi, **S. B. Shah**, and J. Miller. 2002. A Fecal Coliform TMDL Plan for the Big Otter River Basin in Virginia. Watershed Management to Meet TMDL Environmental Regulations (Conference and Exhibition). Ft. Worth, TX: ASAE
10. Brannan, K. M., S. Mostaghimi, T. A. Dillaha, C. D. Heatwole, M. L. Wolfe, M. Al-Smadi, **S. B. Shah**, and J. Miller. 2001. Big Otter River Fecal TMDL: A Case Study. 2001 ASAE international meeting. Paper No.01-2067. St. Joseph, MI: ASAE.
11. Dillaha, T. A., S. Mostaghimi, M. L. Wolfe, C. Heatwole, **S. B. Shah**, K. Brannan, J. Miller, and M. Al-Smadi. 2000. The North River TMDL Project - Lessons Learned. 2000 SWCS international meeting poster.
12. Heatwole, C. D., M. L. Wolfe, **S. B. Shah**, S. Mostaghimi, J. Miller, T. A. Dillaha, D. Cherry, R. Currie, K. Brannan, and M. Al-Smadi. 2000. Fecal coliform TMDLs for three animal-intensive watersheds in Virginia. 2000 ASAE international meeting. Paper No. 002085. St. Joseph, MI: ASAE.
13. **Shah, S. B.**, M. L. Wolfe, and J. T. Borggaard. 1999. A two-dimensional model for simulating the fate of subsurface-banded nitrogen. 1999 ASAE/CSAE international meeting. Paper No. 992140. St. Joseph, MI: ASAE.
14. **Shah, S. B.** and M. L. Wolfe. 1998. Agronomic and water quality impacts of urea pellets versus granules. 1998 ASAE international meeting. Paper No. 981037. St. Joseph, MI: ASAE.
15. Regmi, S. N. and **S. B. Shah**. 1990. Country report: Nepal's policies and strategies for agricultural mechanization. Presented at the Regional Workshop on Policies and Strategies for Agricultural Mechanization. Beijing, China: RNAM-Govt. of PRC.



16. **Shah, S. B.** and G. Koirala. 1989. Country report: status of design of seeding and planting equipment in Nepal. Presented at the Regional Workshop on Design of Seeding and Planting Equipment. Wisma Kinasih, Indonesia: RNAM-Govt. of Indonesia.
17. **Shah, S. B.** and Y. N. Dev. 1987. Country report: status of design of harvesting and threshing equipment in Nepal. Presented at the Regional Workshop on Design of Harvesting and Threshing Equipment. Delhi, India: RNAM-Govt. of India.

Modified: 12 July 2012