# Education

* **BS** University of Wisconsin Horticulture 1977 graduated with Honors
* **MS** University of Idaho Plant Science 1983 (GPA – 3.9 out of 4.0)
* **PhD** University of Minnesota Agronomy 1986 (GPA – 3.7 out of 4.0)

# Appointments

* **Distinguished Professor,** Plant Science Dept., SDSU (March 2016-present)
* **Professor,** Plant Science Dept., SDSU, 7/98 – present (20% teaching/80% research)
* **Assoc. Professor**, Plant Science Dept., SDSU, 7/93-6/98
* **Assistant Professor**, Plant Science Dept., SDSU, 8/89-6/93
* **Research Agronomist** – (Post doctoral position) USDA-ARS, Soil & Water Management Research Unit, St Paul, MN. 7/86-8/89

**Research topics**:

* Weed biology and physiology
* Crop/weed interactions including corn, wheat, barley, oil seed crops (sunflowers, flax, soybean), rangeland, and pastures.
* Precision agriculture to assess weed variability across landscape positions.
* Herbicide-soil- antibiotic interactions to limit or eliminate herbicide contamination of surface and ground water.
* Transcriptome and stable isotope (13C and 15N) analysis explore weed-crop interactions on corn and soybean, crop effects on weeds, and abiotic stress effects on corn.
* Nonchemical options for weed control including tillage, crop rotations, cover crops, grit sprayer applications, and biocontrol options.
* IR-4 research to examine herbicide/pesticide residue in minor use crops

**Overview of accomplishments (details of grant activity, graduate students, and papers/presentations presented in supplemental information):**

*Teaching:*

* Taught over 600 undergraduate students, who obtained employment in crop consulting firms, agronomists for major chemical and seed companies, or work on their family farm.
* Research advisor for 23 MS, 6 PhD, and 4 post-doctoral students who have gone on to work for seed/chemical companies, NRCS, USDA, and universities.
* Co-wrote an undergraduate book “Mathematics and calculations for agronomists and soil scientists” published by IPNI. Published in English and metric units. This book has been translated book into Portuguese, and Spanish.

*Research:*

* Understanding of weed/crop competition, herbicide fate in northern environments, weed biology, biocontrol of perennial weeds, and improved weed management in cropping fields and rangeland.
* Pesticide residues in crops based on application timing.
* Multidisciplinary projects that have included entomologists, soil scientists, plant physiologists, environmental engineers, ag engineers, microbiologists, production agriculture specialists, animal scientists, weed scientists, and GIS specialists. The projects have been coordinated at the university, regional (NDSU, U of MN, U of MO, KState, U of IL, Ohio State, U of WI, U of NE, U of IA, MSU, Purdue) and national levels (ARS in Brookings, St. Paul, MN, Morris, MN, Fargo, ND, Champaign, IL, Stoneville, MS).
* I have led multidisciplinary teams to investigate biocontrol of weeds with insects and diseases; mob grazing effects on carbon sequestration, soil quality, range condition, and invasive species in rangeland; control of invasive grass species and saltcedar in grassland; and cover crop effects on soil quality, insect diversity, weed management in corn, soybean, and wheat.
* **Grants:** over $10 million in grant support as PI for these projects and over $50 million in total grant support as Co-PI or collaborator.
* **Publications:** These research projects and grant dollars have resulted in over 130 peer reviewed papers, 4 books, and numerous book chapters and presentations. Numerous research awards including WSSA paper of the year in Weed Science (three times), and my graduate students have been recognized as outstanding at national and international meetings. Total citations – 2570; h index = 27; i10 index = 78)

*Extension:*

* Presented results at many field days for growers
* I have been involved in writing and editing “SD Best Management Practices for Corn”, wrote two chapters “iGrow Best Management Practices for Wheat” and am co-editor and author of two chapters in “iGrow Best Management Practices for Soybean”, and for the new Corn Management manual, have written 4 chapters. A new Precision Farming Curriculum manual is being prepared and I am Co/Lead author for two chapters. I have presented over 12 invited presentations at universities and international meetings.

**AWARDS AND HONORS:**

* USDA-Edminster Award, 1987; Gamma Sigma Delta Research Award, 1996; Dean’s Award for Teaching/Research Excellence, 1997; F.O. Butler Award Excellence in Research 1997; Sigma Xi Research Award, 1999; Gamma Sigma Delta Teaching Award 2002; SD AES Griffith Faculty Research Award, 2005; IR-4 Meritorious Service Award, 2005; Weed Science paper nominated for best paper of the year 2005; Agronomy Journal paper selected by journal staff for Science in Action review, 2005; **Weed Science Best Paper of the Year, 2007; ASA Fellow, 2009;** Chair for Agricultural Systems (A-8) in the American Society of Agronomy; Corn Best Management Practices, selected for excellence by ASA 2010; Woman of Distinction – SDSU 2010; Dean’s Team Award for Excellence in Extension (2004); Teaching (2005); Research (2005); **Weed Science Best Paper of the Year 2012; American Society of Agronomy President 2013; Weed Science Paper of the Year 2013;** SDSU Distinguished Professor, 2016.
* **Gamma Sigma Delta** –Executive Committee 2009-2013 (President 2012); Executive committee 1997- 2001 (President, 2000); International Gamma Sigma Delta Agriculture Service Award, 2017
* **Sigma Xi** ExecutiveCommittee (President) President’s Service award, 2001.

# International Recognition:

* Invited speaker CCA program Toluca, Mexico (September 2014)
* Invited speaker South African Precision Ag Congress (April 2013)
* Invited keynote speaker and panel leader for Global Agronomy session, International Agronomy Conference, New Delhi, India (Nov. 2012)

# Worked with Dr. F. Pati, Boliva (2.5 yr 2009-2011)

# Worked with Dr. Aguilar, Mexico (worked in my lab for 3 summers, co-wrote journal articles)

# Drs. Rola and Sadowski, Poland (co-wrote international grant proposals)

# Invited speaker to NATO Conference (see invited presentation) 1997.

# Invited keynote speaker, Mexican Weed Science Society, 1996.

# Initiated an undergraduate student fund for Mexican Weed Science Society.

# Invited speaker at Mexican Herbicide Resistance Workshop, 1999.

# Publications:

# Books

* Clay, D.E., S.A. Clay, and S.A. Bruggeman (eds) 2017. Practical Mathematics for Precision Farming. ASA.
* Clay, D.E., S.A. Clay, and E. Bykumama.(eds) 2016. Best Management Practices for Corn Production in South Dakota SD Coop Ext. Serv.
* Clay, S.A. (ed) 2011. GIS Application in Agriculture. Volume Three: Invasive Species CRC Press, publisher.
* Clay, D.E., G.C. Carlson, S.A. Clay, and S. Morrell. 2010. Mathematics and Calculations for Agronomy Students. IPNI publisher.
* Clay, D.E., G.C. Carlson, S.A. Clay, and S. Morrell. 2012. Mathematics and Calculations for Agronomy Students- Metric Edition. IPNI publisher.
* Clay, D.E., R.D. Reitsma, and S.A. Clay (eds). 2009. Best Management Practices for Corn Production in South Dakota. SD Coop. Ext. Serv.

# Partial listing of refereed publications (Total 130+, partial examples 2005-2015) (Total citations – 2570/h-index 27/i10 index of 78)

* Erazo-Barradas, M., C. Friedrichsen, F. Forcella, D. Humburg, and S.A. Clay. 2017. Propelled abrasive grit applications for weed management in transitional corn grain production. Renewable Agric. Food Systems
* Mueller, T.C. et al. 2017. Enhanced atrazine degradation is widespread across the United States. Pest Management Science.
* Clay, D.E., S.A. Clay, T.M. DeSutter, and C. Reese. 2017. From plows, horses and harnesses to precision technologies in the North American Great Plains. Oxford Res. Encyc. Envir. Sci. http://environmentalscience.oxfordre.com/view/10.1093/acrefore/9780199389414.001.0001/acrefore-9780199389414-e-196 March, 2017.
* Chang, J., D.E. Clay, S.A. Clay, A.J. Smart, and M.K. Ohrtman. 2017. A rapid method for measuring feces ammonia-nitrogen and carbon dioxide-carbon emissions and decomposition rate constants. Agron J. 109: (First look published May 25, 2017)
* Clay, D.E. G. Carlson, J. Chang, G. Reicks, S.A. Clay, and C. Reese. 2017. Calculating soil organic turnover at different landscape positions in precision conservation. In Delgado J., S. Sassenrath, and T. Mueller (ed.). Agronomy Monograph 59, Precision Conservation: Geospatial Techniques and Natural Resource Conservation. American Society of Agronomy, Madison WI (June 2017)
* Smart, A.J., L.B. Perkins, T. N. Schramm, M.J. Nelson, P.J. Bauman, S.A. Clay, and D.E. Clay. 2016. The Effects of Patch-Burn Grazing on Vegetation Structural Heterogeneity in the Northern Tallgrass Prairie of South Dakota. Great Plains Research. 24: 57 (Charles Bessey Award Winning Paper) The paper was, “The Effects of Patch-Burn Grazing on Vegetation Structural Heterogeneity in the Northern Tallgrass Prairie of South Dakota.” The paper is the winner of the 2017 Charles E. Bessey Award for the best paper in natural sciences published in Great Plains Research during the volume year 2016. The Charles E. Bessey annual award includes a cash prize of $250.00.
* Alms, J.; Clay, S.A.; Vos, D.; Moechnig, M. 2015. Yield loss and management of volunteer corn in soybean. Weed Tech.
* Chang, J.;Clay, D.E.; Smart, A.J.;Clay, S.A. Estimating live root-to-shoot ratios of northern tallgrass prairie vegetation.
* Clay, S.A.; Krack, K.; Hansen, S.A.; Papiernik, S.; Schumacher, T. Maize, switchgrass, and ponderosa pine biochars added to soil increased herbicide sorption and decreased herbicide efficacy. Plant and Soil
* Reitsma, K.; Dunn, B.; Mishra, U.; Clay, S.A.; DeSutter, T.; Clay, D. The sustainability of agricultural intensification in a climate and vegetation transition zone. Agron. J.
* Janssen, L.; McMurtry, B.; Stockton, M.; Smart, A.; Clay, S.A. 2015. An economic analysis of high-intensity, short duration grazing systems in South Dakota and Nebraska. Agricultural & Applied Economic Assoc. San Francisco, CA July 2015.
* Clay, David E; Reicks, Graig; Carlson, C Gregg; Moriles-Miller, Janet; Stone, James J; Clay, Sharon A. 2015. Tillage and corn residue harvesting impact surface and subsurface carbon sequestration. JEQ. doi:10.2134/jeq2014.07.0322
* Horvath, David P; Hansen, Stephanie A; Moriles‐Miller, Janet P; Pierik, Ronald; Yan, Changhui; Clay, David E; Scheffler, Brian; Clay, Sharon A. 2015. RNAseq reveals weed‐induced PIF3‐like as a candidate target to manipulate weed stress response in soybean. New Phytologist. doi: 10.1111/nph.13351. [Epub ahead of print]
* Ohrtman, Michelle K; Clay, Sharon A; Smart, Alexander J. 2015. Surface temperatures and durations associated with spring prescribed fires in eastern South Dakota tallgrass prairies. American Midland Naturalist173:88-98.
* Clay, S.A. 2015. Pliable plants. March, MIT Technology Review. (editorial piece)
* Clay, D.E. G. Carlson, J. Chang, G. Reicks, S.A. Clay, and C. Reese. 201?.  Determining C budgets and estimating the potential impact of precision conservation on soil organic carbon maintenance.  pp\_\_\_\_\_\_, J. Delgado (ed.). *Precision Conservation.* ASA.  (In press).
* Park, H., D.E. Clay, R.G. Hall, J.S. Rohila, T.P. Kharel, S.A. Clay, and S. Lee. 2014. Winter wheat quality responses to water, environment, and nitrogen fertilization. Communications in Soil Sci. Plant Analysis. 45:1894-1905.
* Chang, J., D.E. Clay, S.A. Hansen, S.A. Clay, and T.E. Schumacher. 2014. Water stress impacts on transgenic drought-tolerant corn in the Northern Great Plains. Agronomy J. 106:125-130.
* Clay, D.E., S.A. Clay, K.D. Reitsma, B.H. Dunn, A.J. Smart, C. G. Carlson, D. Horvath, and J.J. Stone. 2014. Does the conversion of grasslands to row crop production in semi-arid areas threaten global food supplies? Global Food Security. 3:22-30.
* Lou, Y., S.A. Clay, A.S. Davis, A. Dille, J. Felix, A.H.M. Ramirez, C.L. Sprague, and A. C. Yannarell. 2014. An affinity-effect relationship for microbial communities in plant-soil feedback loops. Microbial Ecology. 67:866-876.
* Clay, S.A., A. Davis, A. Dille, J. Lindquist, A.H.M. Ramirez, C. Sprague, G. Reicks, and F. Forcella. 2014. Common sunflower seedling emergence across the U.S. Midwest. Weed Sci. 62:63-70.
* Reese, C.L., D.E. Clay, S.A. Clay, A.D. Bich, A.C. Kennedy, S.A. Hansen, and J. Moriles. 2014. Winter cover crops impact on corn production in semiarid regions. Agron. J. 106:1479-1488.
* Ohrtman, M.K., Sharon Clay, Shauna Waughtel, Janet Moriles. 2014. Effectiveness of control treatments on young saltcedar (*Tamarix* spp.) plants. Invasive Plant Science and Management. 7:25-31.
* Bich, A.D., C.L. Reese, A.C. Kennedy, D.E. Clay, and S.A. Clay. 2014. Corn yield is not reduced by in-season cover crop seeded after the weed free period. Crop Management. doi:10.2134/CM-2014-0009-RS
* Lee, S., D.E. Clay, and S.A. Clay. 2014. Chapter 10. Impact of Herbicide Tolerant Crops on Soil Health and Sustainable Agriculture Crop Production. Pg 211 – 238. In: D.D. Songstad, J.L. Hatfield, and D.T. Tomes (eds.). Convergence of Food Security, Energy Security, and Sustainable Agriculture. Springer. 389 pg. ISBN 978-3-642-55261-8.
* Chintala, R., T.E. Schumacher, L.M. McDonald, D.E. Clay, D.D. Malo, S.K. Papiernik, S.A. Clay, and J.L. Julson. Phosphorus sorption and availability from biochars and soil/biochar mixtures. Clean Soil, Air, Water. 41:doi 10.1002/clen.201300089. (9 pg)
* Hansen, S., S.A. Clay, D.E. Clay, C.G. Carlson, G. Reicks, Y. Jarachi, and D. Horvath. 2013. Landscape features impact on soil available water, corn biomass, and gene expression during the late vegetative stage. The Plant Genome 6 doi:10.3835/plantgenome2012.11.0029.
* Asmus, A., S.A. Clay, and C. Ren. 2013. Summary of certified crop advisors response to weed resistance survey. Agron. J. 105:1160-1166.
* Davis, A., S.A. Clay, J. Cardina, A. Dille, F. Forcella, J. Lindquist, and C. Sprague. 2013. Seed burial physical environment explains departures from regional hydrothermal model of giant ragweed (Ambrosia trifida) seedling emergence in U.S. Midwest. Weed Sci. 61:415-421.
* Ohrtman, M.K. and S.A. Clay. 2013. Using a pervasive invader for weed science education. Weed Tech. 27:395-400.
* Smart, A.J., T.K. Christner, S.A. Clay, D.E. Clay, M. Ohrtman, and E.M. Mousel. 2013. Spring clipping, fire, and simulated increased atmospheric nitrogen deposition effects on tallgrass prairie vegetation. Range Ecol Mange 66:680-687.
* Chang, J., D.E. Clay, S. Hansen, S.A. Clay, and T. Schumacher. 2014. Water stress impacts on transgenic drought-tolerant corn in the Northern Great Plains. Ag. J. 106:125-130.
* Lundgren, J.G., L.S. Hesler, S.A. Clay, and S.F. Fausti. 2013. Insect communities in soybeans of eastern South Dakota: the effects of vegetation management and pesticides on soybean aphids, bean leaf beetles, and their natural enemies. Crop Protect. 43: 104-108.
* Ohrtman, M.K., S.A. Clay, D.E. Clay, and A.J. Smart. 2012. Fire as a tool for controlling *Tamarix* spp. seedlings. Inv. Plant Sci. Manage. 5:139-147.
* Clay, D.E., C. G. Carlson, S.A. Clay, J. Stone, K.D. Reitsma, and R.H. Gelderman. 2012. Great Plains soils may be C sinks. Better Crops. 96:20-22.
* Clay, D.E., J. Chang, S.A. Clay, J. Stone, R.H. Gelderman, C. G. Carlson, K. Reitsma, M. Jones, J. Janssen, and T. Schumacher. 2012. Corn yields and no-tillage affects carbon sequestration and carbon footprints. Agron. J. 104:763-770.
* Mamani-Pati, F., D.E. Clay, S.A. Clay, H. Smeltekop, and M.A. Yujra-Callata. 2012. The influence of strata on the nutrient recycling within a tropical certified organic coffee production system. ISRN Agronomy. Article ID 389290 (8 pages)
* Moriles, J., S. Hansen, D.P. Horvath, G. Reicks, D.E. Clay, and S.A. Clay. 2012. Microarray and growth analyses identify differences and similarities of early corn response to weeds, shade, and nitrogen stress. Weed Sci. 60:158-166.
* Wortman, S.E., A.S. Davis, B.J. Schutte, J.L. Lindquist, J. Cardina, J. Felix, C.L. Sprague, J.A. Dille, A.H.M. Ramirez, G. Reicks, and S.A. Clay. 2012. Local conditions, not regional gradients, drive demographic variation of *Ambrosia trifida* and *Helianthus annuus* across northern US maize belt. Weed Sci. 60:440-450.
* Clay, S.A. and D.D. Malo (2012). The Influence of Biochar Production on Herbicide Sorption Characteristics, Herbicides - Properties, Synthesis and Control of Weeds, Mohammed Naguib Abd El-Ghany Hasaneen (Ed.), ISBN: 978-953-307-803-8, InTech, Available from: <http://www.intechopen.com/articles/show/title/the-influence-of-biochar-production-on-herbicide-sorption-characteristics>
* Obade, V.P., D.E. Clay, C.G. Carlson, K. Dalsted, B. Wylie, C. Ren, and S.A. Clay. 2011. Estimating non-harvested crop residue cover dynamics using remote sensing. *In* Biomass and Energy Production. InTech ISBN 978-953-307-491-7.
* Ohrtman, M.K., S.A. Clay, D.E. Clay, E.M. Mousel, and A.J. Smart. 2011. Preventing saltcedar (*Tamarix* spp.) seedling establishment in the northern prairie pothole region. 4:427-436.
* Kharel, T., D.E. Clay, S.A. Clay, C.G. Carlson, D. Beck, C. Reese, and H. Park. 2011. Nitrogen and water stress affect winter wheat yield and dough quality. Agron. J. 103:1389-1396.
* Stone, J.J., K. R. Aurand, C.R. Dollarhide, R. Jinka, R. C. Thaler, D.E. Clay, and S.A. Clay. 2011. Determination of environmental impacts of antimicrobial usage for US Northern Great Plains swine-production facilities: a life-cycle assessment approach. Int. J. Life Cycle Assess. 16:27-39.
* Reitsma, K.D. and S.A. Clay. 2011. Using GIS to investigate weed shifts after two cycles of a corn/soybean rotation. Pg 373-404. In: Clay, S.A. (ed) GIS Applications in Agriculture. Volume Three: Invasive Species. CRC Press. Boca Raton, FL.
* French, B.W., K.D. Reitsma, A.A. Beckler, L.D. Chandler, and S.A. Clay. 2011. Geographic Information Systems in corn rootworm management. Pg 233-254. In: Clay, S.A. (ed) GIS Applications in Agriculture. Volume Three: Invasive Species. CRC Press. Boca Raton, FL.
* Mamani Pati, F, D.E. Clay, C.G. Carlson, and S.A. Clay.  2011. Production, economic, and energy life cycle analysis can produce contrary results for corn used in ethanol production.  J. Plant Nutrition. 34:1278-1289.
* Clay, D.E., C.G. Carlson, S.A. Clay, V. Owens, T.E. Schumacher, and F. Mamani Pati.  2011. Historic soil organic carbon turnover studies revisited. J. Environ. Qual.  In review.
* Clay, D.E., C.G. Carlson, and S.A. Clay. 2011. Maximizing nutrient efficiency through the adoption of management practices that maintain soil organic carbon, calculating carbon turnover kinetics. *In* D.E. Clay and J. Shanahan (ed.). GIS in Agriculture: Nutrient Management for Improved Energy Efficiency. Vol 2. CRC Press.
* Reese, C., D. Long, D. Clay, S. Clay, and D. Beck. 2010. Nitrogen and water stress impact hard red spring wheat. J. Terrestrial Observations Vol. 2: Iss. 1, Article 7.   
  Available at: http://docs.lib.purdue.edu/jto/vol2/iss1/art7
* Mamani Pati, E.M., D.E. Clay, C.G. Carlson, and S.A. Clay.  2010.  Calculating soil organic carbon maintenance using stable and isotopic approaches:  A review.  Pg 189-216. *In* Lichtfouse (ed.).  Sustainable Agricultural Reviews: Vol. 3: Sociology, Organic Farming, Climate Change and Soil Science, Springer.
* Mamani-Pati, F., D.E. Clay, C.G. Carlson, S.A. Clay, G. Reicks, and K. Kim. 2010. Nitrogen Rate, Landscape Position, and Harvest Corn Stover Impacts on Energy Gains and carbon budgets of Corn Grown in South Dakota. Agron Journal. 102:1535-1541.
* Lehnert, K., V.S. Brözel, S.A. Gibson, R. Thaler, and S. A. Clay. 2010. Influence of manure from pigs fed chlortetracycline as growth promotant on soil microbial community structure. W. J. Microbiol Biotechnol Online First July 2010
* Rettedal, E., S. Clay and V.S. Brözel. 2010. GC-clamp primer batches yield 16S rRNA gene amplicon pools with variable GC clamps, affecting denaturing gradient gel electrophoresis profiles. FEMS Microbiol Letts: 312: 55 - 62
* Stone, J.J., S.A. Clay, G.M. Spellman. 2010. Tylosin and chlortetracycline effects during swine manure digestion: Influence of sodium azide. Bioresource Technol. 101:9515-9520.
* Uscanga-Mortera, E., S. A. Clay, F. Forcella and J. Gunsolus. 2008. Common Waterhemp Growth and Fecundity as Influenced by Emergence Date and Competing Crop. Crops and Soils. (Article rewritten from a 2007 Agron. J. article for CCA credit).
* Sakaliene, O., S. A. Clay, W. C. Koskinen, and G. Almantas. 2008. Early Season Weed suppression in buckwheat using clopyralid. Weed Tech. 22:707-712.
* Reiman, M., D.E. Clay, C.G. Carlson, S.A. Clay, G. Reicks, D.W. Clay, and D.E. Humburg. 2009. Manure placement depth impacts on crop yields and N retained in soil. J. Envrion. Sci. Health (B). 44:76-85.
* Hoese, A. S.A. Clay, D.E. Clay, J. Oswald, T. Trooien, R. Thaler, and C.G. Carlson. 2009. Chlortetracycline and tylosin runoff from soils treated with antimicrobial containing manure. J. Envrion. Sci. Health (B)
* Horvath, D.P., D. Llewellyn, and S.A. Clay. 2007. Heterologous hybridization of cotton (*Gossypium hirsutum*) microarrays with velvetleaf (*Abutilon theophrasti*) reveals physiological responses due to corn competition. Weed Sci. 55:546-557.  **NOTE: This paper received the WSSA OUTSTANDING PAPER in WEED SCIENCE Oct. 2007- Oct. 2008**
* Kim, K., D.E. Clay, C.G. Carlson, S.A. Clay, and T. Trooien. 2008.  Do synergistic relationships between nitrogen and water influence the ability of corn to use nitrogen derived from fertilizer and soil? Agron. J. 100:551-556.
* Clay, D.E., C.G. Carlson, S.A. Clay, C. Reese, Z. Liu, and M.M. Ellsbury.  2006.  Theoretical Derivation of New Stable and Non-isotopic Approaches for Assessing Soil Organic C Turnover.  Agron. J.
* Clay, D.E., S.A. Clay, and C.G. Carlson. 2006. Site-specific management from a cropping systems perspective. In Srinivasan, A. (ed) Precision farming – A global perspective. Haworth Press, Inc
* Clay, S.A., B. Kruetner, D.E. Clay, C. Reese, J. Kleinjan. 2006. Spatial distribution, temporal stability, and yield loss estimates for annual grasses and common ragweed in corn/soybean production field over nine years. Weed Sci.
* Clay, S.A., K. Banken, M.M. Ellsbury, and F. Forcella. 2006. Influence of yellow foxtail on corn growth and yield. Comm. Soil Plant Anal.
* Chang, J., S.A. Clay, D.E. Clay, D.Aaron, D. Helder, and K. Dalsted. 2005. Clouds influence precision and accuracy of ground-based spectroradiometers. Comm. Soil Sci. Plant Anal. 36:1799-1807.
* Clay, S.A., Z. Liu, R. Thaler, and H. Kennouche. 2005. Tylosin sorption to silty clay loam soils, swine manure, and sand. J. Environ. Sci. Health Part B. 40:841-850.
* Clay, S.A., J. Kleinjan, D.E. Clay, F. Forcella, and W. Batchelor. 2005. Growth and fecundity of several weed species in corn and soybean. . **(selected for Science in Action designation by the journal staff)** Agron. J. 97:294-300.
* Clay, D.E., S.A. Clay, D.J. Lyon, and J. Blumenthal. 2005. 13C discrimination in corn grain can be used to separate and quantify yield losses due to water and nitrogen stresses. Weed Sci. 53:23-29.
* Ellsbury, M.M., S.A. Clay, D.E. Clay, and D.D. Malo. 2005. Chapter 7. Within-field spatial variation of northern corn rootworm distributions. In: S. Vidal et al. eds. Western Corn Rootworm: Ecology and Management. (in press)
* Hummel, L. and A.S. Mayer. 2005. The fate of 2,4-D in intact soybean (Glycine max). SDSU J. Undergraduate Res. 3: 39-48. (S.A. Clay advisor)
* Hummel, L., A.S. Mayer, and S.A. Clay. 2005. The fate of 2,4-D in intact soybean (Glycine max). Proc. SD Acad Sci. 84:225-234

### OTHER PUBLICATIONS - Conference Proceedings

* I have authored or co-authored numerous publications for conference proceedings at the state, national and international level.

# INVITED PRESENTATIONS (Examples)

* I have been invited to present my research findings to state, national and international meetings.
* Clay, S.A. 2013. Precision Agriculture, More than Soil – South Africa Postchestroom University.
* Clay, S.A. 2013. Agronomy in the 21st Century. University of Massachusetts
* Clay, S.A. 2012. Using 21st century tools to advance agronomic research. Third International Agronomy Congress. New Delhi, India
* Clay, S.A. 2008. Using new tools for weed/crop competition. Kansas State University.
* Clay, S.A. 2006. What’s up with pharmaceuticals in the environment? 18th Annual Water Quality Conference, March 2006. Pierre, SD
* Clay, S.A. 2005. The use and fate of herbicides in South Dakota. NRCS invited presentation for Conservation Officers Workshop. Huron, SD March 2005.
* Clay, S.A., D.E. Clay, and T.B. Moorman. 2002. Comparison of two herbicides sorption, mineralization and degradation potential in surface and aquifer sediments. ACS Symposium. August, 19, 2002. Boston, MA.

**ABSTRACTS** Since 1989, I have also authored or co-authored over 90 meeting abstracts for presentation at regional, national and international meetings.

**EXTERNAL FUNDING** (Author or co-author, **Partial** listing of titles, agencies, and amounts, pending grants not included in this list)

* I have been an author or co-author on grants in several areas to different agencies. Since 1989, I have received $10 M in external grant funds directly to SDSU for weed science and related projects and have been involved with multi-institutional projects that have totaled close to $50 M.
* Clay, S.A. 1989. Frozen soil effects on herbicide movement and weed ecology in conventional and alternative management systems. Experiment Station Research Project. 5 yrs.
* Clay, S.A. 1990. Herbicide sorption characterization of benchmark soils, SDAES participation in NAPIAP. 1 year funded. $7,200
* Clay, S.A. 1990. Varietal differences to trifluralin carryover as influenced by several spring wheat herbicides. South Dakota Wheat Commission. 2 years funded. $20,000
* Clay, S.A. 1990. Biocontrol of leafy spurge and spotted knapweed. 3 years funded. $35,000
* Clay, S.A., D.E. Clay, D. Rickerl, and R. Kohl. 1990. Tillage and ammonia banding on water N, and herbicide movement. USGS-105. 2 years. $150,000
* Clay, S.A. 1991. Herbicide sorption characterization of benchmark soils, SDAES participation in NAPIAP. USDA-CSRS. 1 year funded. $7,200
* Clay, S.A., D.E. Clay, and T.E. Schumacher. 1991. Tillage effects on agrichemical fate in soil and aquifer. USGS-104. 1 year funded. $10,000
* Clay, S.A., D.E. Clay, and T.E. Schumacher. 1991. Alachlor degradation and denitrification in the Big Sioux aquifer. CEPA. 2 yr. $95,800.
* Clay, S.A. 1992‑ 1993. Herbicide sorption characterization of benchmark soils, SDAES participation in NAPIAP. USDA‑CSRS. 1 year funded. $7,200.
* Clay, S.A. and D.E. Clay. 1991. The impact of soil chemical conditions produced by NH4+ based fertilizers on agrichemical movement. TVA. 2 years funded. $25,850.
* Clay, D.E., G.L. Malzer, T.E. Schumacher, and S.A.Clay. 1991. Tillage induced microrelief impacts on NO3‑ and atrazine movement in soils. USDA‑ARS. 3 years funded. $196,000.
* Clay, D.E., S.A. Clay, T.E. Schumacher, and D.Sorenson. 1991. Tillage induced microrelief impacts on nitrate and herbicide movement in soils above the Big Sioux and Parker‑Centerville aquifers. SD‑CEPA. 2 years. $57,910.
* Clay, S.A. and B. Turnipseed. 1992. Preventing distribution of viable noxious weeds from grain screenings. SDWeed & Pest Commission $16,000
* Clay, S.A. 1990. Biological control of weeds. SD Weed & Pest Commission. 3 yr grant. $35,000
* Clay, S.A. 1993. Leafy Spurge Biocontrol: Flea Beetle Ecology. Co‑operative agreement with USDA‑ARS 2 yr. $15,000
* Clay, S.A. 1993‑1994. Fate of alachlor in soil and aquifer materials. 1 year funded. NAPIAP. $7,200.
* Clay, S.A. 1994‑1995. The fate of agrichemicals in wind‑blown sediments. NAPIAP. $6,300.
* Clay, S.A. 1995‑1998. Synergistic effect of biocontrol agents Aphthona nigriscutis and *Pseudomonas fluorscens* for control of leafy spurge (*Euphorbia esula*). SD Weed & Pest

Commission. 3 yr grant $35,000.

* Clay, S.A., M.M. Ellsbury, F. Forcella, and D.E. Clay. 1995‑1998. Integrated farming system management utilizing nested databases on the watershed level. $180,000
* Clay, D.E., S.A. Clay, C.G. Carlson, T.E. Schumacher, and D.D. Malo. 1995. Integrated farming systems managements utilizing nested databases on a watershed level. USGS‑104. $7,000
* Clay, S.A., D.E. Clay, and R. Vos. 1995. The effect of spring seeded annual medic as a possible weed management system in corn. NC Sustainable Ag. 2 yr. $72,000
* Clay, D.E., S.A. Clay, W. D. Woodson, and D. Helder. 1996-1999. Integrated systems management of watersheds for economic and environmental integrity. USDA-NRI. $188,000.
* Clay, S.A. 1996. Fate of herbicides on windblown sediment and strategies to control ALS-resistant kochia. NAPIAP. $13,500.
* Clay, D.E., S.A. Clay, C.G. Carlson. 1996, 1997, 1998, 1999. Precision farming in soybeans. SD Soybean Research and Promotion Council. $6,000/yr
* Clay, S.A. 1993, 1994, 1996, 1997, 1998, 1999, 2000, 2001. IR-4 projects. Herbicide residue in flax, canola, and sunflowers. Total: $55,000.
* Clay, D.E., S.A. Clay and C.G. Carlson. 1996, 1997, 1998, 1999. Precision farming applications in corn. SD Corn Utilization Council. $5,000/yr.
* Clay, S.A., D.E. Clay, and C.G. Carlson. 1997. Site specific integrated pest management. North Central IPM. $75,000.
* Broulik, B, S.A. Clay, D.E. Clay. 1997. Remote sensing project. Graduate student scholarship from Space Grant Consortium. $10,000.
* Cole, C., D.E. Clay, and S.A. Clay. 1998. Remote sensing project. Graduate student scholarship from Space Grant Consortium. $10,000.
* Fund For Rural America. 2000-2003. Lead Institution University of Minnesota. SDSU project $785,000 to SDSU
* EPSCoR NSF Biocomplexity grant. 2000-2003 Member of state team to examine biocomplexity across South Dakota. Approx. $500,000/yr
* EPSCoR NASA grant. 2000-2005. Member of SDSU team. Calibration of remote sensed images and using these data for agricultural decision making. Approx. $185,000/yr
* USDA-NRI 2001-2003. Precision farming in the Great Plains. $150,000
* 2002 IR-4 participation. Pesticide residue on minor use crops – 13 projects - $39,000.
* Clay, S.A., D.E. Clay, D.D. Malo, K. Dalsted, T. Trooien. 2002. Rushmore postdoctoral research fellowship. Wanted: Geographic systems spatial analyst to link data layers through GIS modeling. 2 years. $70,000.
* Trooien, T., S.A. Clay, and R. Thaler. SD AES grant. 2002 – 2004. Assessing potential transport of antibacterial chemicals in the landscape. $17,760/yr.
* 2003-2015 IR-4 participation. Pesticide residue on minor use crops – typically 6 projects - $20,000 - $30,000 annually
* Clay, S.A., S. Gibson, and V. Brozel. US-EPA. Assessing the impact of pharmaceuticals on environmental processes. August 2005-2007. $100,000.
* SD Commodity group support (Corn, Soybean, Wheat) for ongoing projects (ranging from $3000-$5000 annually per group)
* USDA-Challenge grant. 2005. Scientific principles in agronomic science. $150,000
* Griffith Faculty Research Award, SD AES 2005-2006. $24,000.
* USEPA. 2007. Antimicrobials in the environment. $100,000
* NSF. 2007. Breakdown of hog manure in the presence of antimicrobial compounds. $250,000 (with J. Stone, SDSMT)
* USGS 104 program 2005 and 2006 Site specific manure placement for protecting environmental quality. $20,000
* USDA-NRI. 2008. Using microarray analysis to examine weed/crop competition. $175,000
* USDA-Grassland. 2008. Fire, Atmospheric N deposition, and water availability impacts on species composition, forage availability, and invasive species prevention. $636,379
* USDA-CIG. 2009. Cover crops for the cold northern environments. $600,000.
* US-DOE 2008. Kelly, V., H. Lei, J. Julson, and S.A. Clay. Biochar source/properties impact on soil properties and herbicide sorption. US-DOE $60,000 total ($9,000 for sorption analysis).
* SD Mini-grant. Berdanier, B. W. and S.A. Clay. 2008-2010. Development of analytical capabilities for the examination of treatment potential of human pharmaceutical compounds in municipal wastewater $20,000
* Monsanto. 2009-2011. Clay, D.E., T. Schumacher, S.A. Clay.  Quantifying water and N budget in drought tolerant corn.  $147,591/yr.
* NC-SARE. 2010 Frank Forcella and Sharon Clay. $200,000 Abrasive sprayer for weed control in organic crops.
* SD Soybean Board. 2009. Gregg Carlson, David Clay, Sharon Clay, Larry Janssen, Peter Sexton and Robert Hall.  $140,000.  Development, Refining, and Communicating Soybean Best Management Practices to SD Soybean Producers.
* USDA-IPM 2011-2014. Development and demonstration of a new method of physical weed control Clay, S.A., F. Forcella, and D. Humburg. $175,000
* USDA-AFRI 2011-2014. Clay, D.E. and S.A. Clay. Screening current plant genotypes suitable for seed quality. $325,000
* NC-SARE. 2011. Sara Winterholler, S.A. Clay, D.E. Clay, and A. Smart. Mob grazing increases efficiency and profitability of livestock production. $200,000
* USDA-NRCS-CIG. 2012-2014 S.A. Clay, A. Smart, D. Clay and NE cooperators Demonstrating Mob Grazing Impacts in the Northern Great Plains on Grazingland Efficiency, Botanical Composition, Soil Quality, and Ranch Economics. $859,000 (1.6 M with match)
* USDA-NRCS-CIG. 2011-2013. S.A. Clay, A. Smart, D. Clay. Atmospheric N deposition and invasive species in Northern Great Plains rangelands $850,000 (1.6 M with match)
* SD Corn Utilization Council. 2012. Clay, D.E., C.G. Carlson, S.A. Clay, and D.D. Malo. Optimizing corn production in tile-drained salt effected SD soils. $67,700.
* North Central Soybean Board. 2013-2014. Mutch, D. et al. Understanding cover crops in soybean production systems $137,645
* USDA-AFRI Fellowship. 2012-2015. Ohrtman, M. and S.A. Clay. Understnaing establishment requirements and management strategies for northern U.S. saltcedar infestations. $130,000.
* SDSU RSSF. 2013-2014 Corn and Teosinte. Hansen, S., S.A. Clay, D.E. Clay. $7500
* USDA-NRCS-CIG. 2013-2015. A. Smart, S.A. Clay, D.E. Clay Demonstrating Grazing Land Resilience to Drought in the Northern Great Plains . $850,000 (1.6 with Match)
* USDA-NRCS-CIG. 2013-2015. T. DeSutter et al. Reducing sodification in high risk northern Great Plains soils. $850,000 ($1.6M with Match)
* USDA-NRI. 2011-2016. T. Schumacher et al. Biochar use for soil. $1,000,000
* SD Soybean Board. 2014. Gregg Carlson, David Clay, Sharon Clay, Larry Janssen, Peter Sexton.  $140,000.  Development, Refining, and Communicating Soybean Best Management Practices to SD Soybean Producers.
* USDA-OREI 2014-2018. Wortman, S., F. Forcella, and S.A. Clay. Abrasive grits for management in organic systems. $750,000
* SD Soybean Board. 2014. Sharon Clay, Darrel Deneke, Sen Subramarian.   $105,000.  Weed Management in South Dakota Soybean. Soybean Producers.
* SD Soybean Board. 2015. Sharon Clay, Paul Johnson.   $90,000.  Weed Management in South Dakota Soybean. Soybean Producers.
* USDA-AFRI-HCGP. 2014-2018. Clay, D.E., N. Kitchen, S.A. Clay et al. Precision farming workforce development: standards, working groups, and experiential learning curricula. $682,000