

## ASHEESH K. SINGH

Associate Professor

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Google Scholar Profile @ <http://scholar.google.ca/citations?user=lzTBffEAAA&hl=en>

### EDUCATION

- 2003-2007 Ph.D. University of Guelph, Plant Genetics and Breeding, Maize Breeding.  
1998-2001 M.Sc. University of Saskatchewan, Plant Science, Barley Breeding.  
1994-1998 B.Sc. Agriculture and Animal Husbandry, G.B Pant University, Electives in Genetics and Plant Breeding

### APPOINTMENTS

- 2017-present Associate Professor, Department of Agronomy, Iowa State University of Science and Technology. *Nine month appointment: 80% Research, 20% Teaching*  
2018 - Director of Graduate Education (Plant Breeding)  
2013-2017 Assistant Professor, Department of Agronomy, Iowa State University of Science and Technology. *Nine month appointment: 80% Research, 20% Teaching*  
2007-2013 Research Scientist, Durum wheat breeder (Permanent position), Agriculture and Agri-Food Canada. *12 month appointment: 100% research*  
2001-2002 Research Assistant, Crop Development Center, University of Saskatchewan (Barley and Oat breeding)

### HONORS AND AWARDS

- 2017 Faculty Fellow, Plant Sciences Institute, ISU.  
2013 Sustainable Futures Award, Agricultural Institute of Canada.  
2013 Monsanto Chair in Soybean Breeding. Iowa State University.  
2000 T.C. Vanterpool Memorial Prize for Outstanding Student in Plant Pathology and Mycology, Runner-up, Canadian Society of Phytopathology.  
1998 Vice-Chancellor's Gold Medal, College of Agriculture, G B Pant University.

### CAREER FUNDING SUMMARY

- Total funded as PI or co-PI: \$97,259,252\$
  - Total funding to A K Singh: \$13,896,620\$
- \$ Includes \$US and \$CDN

### SUMMARY OF PEER REVIEWED PUBLICATIONS

- **103 peer reviewed full papers** in journals and conference proceedings
  - 85 peer reviewed articles published (including, in press) in journals
  - 18 peer reviewed conference full papers

### SUMMARY OF PLANT BREEDING OUTPUTS

- 36 cultivars received registration support
- 13 germplasm lines
- These cultivars were grown in 6.2 million acres (2017; Source: Canadian Grains Commission) with estimated farm cash receipt value of ~\$2 billion in 2017.

**FUNDED GRANTS AT IOWA STATE UNIVERSITY (Since 2013)**

- 29 Leonor L (PI); co-PIs: several from six states including **AK Singh**. Stem diseases. United Soybean Board. \$349,631 per year. 2018-2021. (\$40,000 per year to AKS).
- 28 Carter T (PI); co-PIs: several from eight states including **AK Singh** (sole sub-contractor from ISU). Yield Potential of Commercial Varieties Under Drought- Identifying and Overcoming Weaknesses through Public Breeding Advances. \$465,00 per year. 2018-2021. (\$40,000 to AKS).
- 27 **Singh AK** (PI); co-PIs: A Singh, G Tylka, D Mueller. Breeding high yielding soybean cultivars for Iowa farmers. Iowa Soybean Association. \$300,000. Full amount to AK Singh. 2018-19.
- 26 **Singh AK** (PI). Predictive Phenomics for Prescriptive Breeding. Plant Science Institute. \$225,000.
- 25 **Singh AK** (PI); co-PIs: A Singh, G Tylka, D Mueller, S Dutta. Breeding high yielding soybean cultivars for Iowa farmers. Iowa Soybean Association. \$300,000. Full amount to AK Singh. 2017-18.
- 24 Beattie, G and **AK Singh**. Root and Microbiome Traits to Tailor the Next-Gen Soybean Cultivars. Iowa Soybean Research Center. \$300,000. 2016-2018.
- 23 Sarkar S (PI), co-PIs: B Ganapathysubramanian, A Singh, **AK Singh**. A multi-scale data assimilation framework for layered sensing and hierarchical control of disease spread in field crops. USDA/NSF – Cyber Physical Systems. \$990,471. 2017 – 2020.
- 22 Cademartiri L (PI), co-PIs: **AK Singh**, R Cademartiri. Transparent Soil Technologies for Root and Rhizosphere Phenotyping. NSF EAGER. \$270,000. 2017-2018 (2 years).
- 21 Bhattacharya S (PI), co-PIs: B Ganapathysubramanian, S Sarkar, A Singh, **AK Singh**. Saliency-driven Robotic Networks for Spatio-temporal Plant Phenotyping. USDA/NSF – Robotics. \$815,021. 2016 – 2019.
- 20 McHale L (PI) et al. co-PIs: several state universities USDA-ARS PI's including **AK Singh**. Increasing the Rate of Genetic Gain for Yield in Soybean Breeding Programs. North Central Soybean Research Program. \$3,125,564. 2016-19. ~\$40K to AK Singh per year.
- 19 **Singh AK** (PI); co-PIs: A Singh, G Tylka, D Mueller, M O'Neal, G MacIntosh. Breeding high yielding soybean cultivars for Iowa farmers. Iowa Soybean Association. \$302,000. Full amount to AK Singh. 2016-17.
- 18 Mian R (PI); co-PIs: several from eleven states including **AK Singh** (sole sub-contractor from ISU). Developing Soybean Cultivars and Germplasm with Increased Protein Quantity and Quality for the Midwest and South using Diversity in Cultivated and Wild Soybeans USB meal Mian. United Soybean Board. \$1,513,500. ~\$50,000 to AK Singh per year. Year to Year (5 year project).
- 17 Graef G (PI); co-PIs: several from seven states including **AK Singh** (sole sub-contractor from ISU).. Utilizing unique genetic diversity to combine elevated protein concentration with high yield in new varieties and experimental lines. United Soybean Board. \$456,773. ~\$57,206 to AK Singh per year. Year to Year (5 year project).
- 16 Allen T (PI); Co-PIs: T Wilkerson, M Chilvers, **AK Singh**, D Mueller, A Singh, A Mengistu, J Ray, R Smith. Improved management of charcoal rot. United Soybean Board. \$346,299. \$89,846 to AK Singh. 2016-17.
- 15 C Lawrence-Dill, **AK Singh**, B Ganapathysubramanian. Co-PIs: Multiple participants. D3AI: Data drive discoveries for agricultural innovation. Presidential Initiative for Interdisciplinary Research on data driven science. \$825,000. 2015-18. ~\$275,000 to AKS.
- 14 Lorenz A (PI); Co-PIs: several including **AK Singh**. Initiation of a genomic selection pipeline for public soybean breeders in the North Central Region. North Central Soybean Research Program. \$1,098,813. 2015-18. (project modified after year 1, into a new project as per NCSR)

- directions)
- 13 **Singh AK** (PI); Co-PIs: G Tylka, D Mueller, A Singh, G MacIntosh, M O'Neal. Breeding high yielding soybean cultivars for Iowa farmers. Iowa Soybean Association. \$305,000. Full amount to AK Singh. 2015-16.
  - 12 Mathew F (PI); Co-PIs: E Byamukama, **AK Singh**, S Osborne. Characterization of Fusarium species infecting soybean roots in South Dakota: Species frequency, aggressiveness, and association with soybean cyst nematode pathogen. South Dakota Soybean Research and Promotion Council. \$81,000. 2015-16.
  - 11 Wise K (PI); Co-PIs: A Mengistu, J Ray, R Smith, G Shannon, P Arelli, **AK Singh**, D Mueller, A Singh, T Allen, M Chilvers, M Fakhoury. Improved management of charcoal rot and stem canker. United Soybean Board. \$365,995. \$89,868 to AK Singh. 2015-16.
  - 10 Singh A (PI); Co-PIs: B Ganapathysubramanian, S Sarkar, **AK Singh**, D Mueller, G Tylka. Using engineering tools to identify and quantify biotic and abiotic stress in soybean for customizable agriculture production. Iowa Soybean Association. \$142,824. 2015-18.
  - 9 **Singh AK** (PI); Co-PIs: G Tylka, D Mueller, A Singh, G MacIntosh, M O'Neal. Breeding for high yield yield protection and composition traits in soybean for Iowa farmers. Iowa Soybean Association. \$300,000. Full amount to AK Singh. 2014-15.
  - 8 Diers B (PI), Co-PIs: M Hudson, P Brown, R Nelson, K Rainey, W Beavis, **AK Singh**, G Graef, J Specht, A Lorenz. Acceleration of Soybean Yield and Composition Improvement through Genomic Selection. North Central Soybean Research Program. \$991,374. \$106,000 to AK Singh. 2014-17.
  - 7 **Singh AK** (PI). Soybean breeding. Iowa Crop Improvement Association. \$600,000. Full amount to AK Singh. (non-competitive). 2014-20.
  - 6 Graef G (PI), Co-PIs: K Eskridge, R Nelson, B Diers, **AK Singh**. Accelerating soybean yield improvement by utilizing yield genes from soybean wild relatives. North Central Soybean Research Program. \$459,282. \$55,000 to AK Singh (per year). 2014-17.
  - 5 Cochran EW (PI), Co-PIs: RC Williams, **AK Singh**. Determination of the Economic Opportunity for Soybean Oils for use as a Monomer. Iowa Soybean Association. \$50,000. 2013-14.
  - 4 Hartman G (PI), Co-PIs: E Sikora, C Hill, D Mueller, **AK Singh**, R Schneider, Davis, T Allen, A Catchot, T Irby. Causes and Cures for Delayed Maturity in Soybean. United Soybean Board. \$600,000. \$105,000 to ISU (MS student stipend; D. Mueller is Major professor and funds under his control). 2014-16.
  - 3 Wise K (PI); Co-PIs: A Mengistu, J Ray, R Smith, G Shannon, P Arelli, **AK Singh**, D Mueller, A Singh, T Allen, M Chilvers, M Fakhoury. Improved management of charcoal rot. United Soybean Board. \$366,286. \$69,888 to AK Singh. 2014-15.
  - 2 Cochran EW (PI), Co-PIs: RC Williams, **AK Singh**. Determination of the Economic Opportunity for Soybean Oils for use as a Monomer. United Soybean Board. \$59,643. 2013-14. This grant is a matching grant to the Iowa Soybean Association funded project with the same name.
  - 1 **Singh AK** (PI); Co-PIs: M O'Neal, G MacIntosh, G Tylka, A Singh. Development of multiple pest resistant soybeans for breeding and research purposes using field and molecular tools. Iowa Soybean Association. \$106,916. Full amount to AK Singh. 2013-14.

**TEACHING GRANTS AT IOWA STATE UNIVERSITY (since 2013)**

1. Suza, W. (PI). Co-PIs: several including **AK Singh**. Plant Breeding Master of Science Programs for Africa. Gates Foundation. \$1,643,817. \$78,000 to AK Singh. 2014-16.  
*Participated in grant planning, develop a graduate level course on plant breeding for African universities.*

**SUMMARY OF FUNDED GRANTS PRIOR TO IOWA STATE UNIVERSITY**

**[Funds are in Canadian \$]**

- 23 Kuchenski L, RM DePauw, D Ramlal, G Coulter. AAFC researchers as participants (including AK Singh). The Canadian Wheat Breeding Research Cluster. Agriculture and Agri-Food Canada (AAFC)-Western Grains Research Foundation (WGRF). \$12.17 million. Amount to AK Singh \$1,112,837 per year. (This number is a best faith estimate due to complexity of the government funding budget lines (salaries, non-pay operating, and partnership funding through WGRF); numbers were received from AAFC breeder). 2011-16.
- 22 Singh AK (PI); Co-PIs: C Hamel, R Knox, R DePauw. Increase crop performance through wheat-mycorrhizal interactions. WGRF. \$165,025. Full amount to AK Singh \$165,025. 2011-14.
- 21 Pozniak CJ (PI); Co-PIs: BX Fu, AK Singh. Improving the colour of Canadian Durum wheat for premium pasta markets. WGRF. \$331,876. 2011-14.
- 20 Singh AK (PI), Co-PIs: R Knox, R DePauw, F Clarke, B McCallum, K Ammar, R Singh. Accelerated Incorporation of Leaf Rust Resistance into Canadian durum. WGRF. \$349,155. Full amount to AK Singh. 2009-13. Original project on leaf rust only, with Project extension additional work on stripe rust and marker assisted breeding.
- 19 Knox RE (PI), Co-PIs: H Voldeng, R DePauw, AK Singh. Enhancing Protection of Canadian Spring Wheat Varieties against Fusarium Head Blight and other pathogens and discovering solutions for impact on market traits so as to Ensure Sustainability of Production and Food Safety. Developing Innovative Agri-Products- AAFC and Secan. \$520,000. 2009-13.
- 18 Singh AK (PI) and RM DePauw. To measure grain attributes of CWRS, CWAD, CPS, Hard White and General Purpose wheat. Wheatland Conservation Inc. \$61,000. Amount to AK Singh: \$30,500. 2009-11.
- 17 Singh AK (PI), Co-PIs: R Knox, F Clarke, R DePauw, C Pozniak, I Wise, B Marchylo, L Schlichting, B Beres. Effect of the midge resistance Sml gene on durum wheat end use quality. Alberta Crop Industry Development Fund Inc. (ACIDF). \$194,181. Amount to AK Singh: \$77,576. 2009-12.
- 16 Fetch T (PI): Co-PIs: Multiple. (including AK Singh). Stem rust UG99. Growing forward AAFC. \$11,739,000. Amount to AK Singh: \$71,000. 2009-13.
- 15 Singh AK (PI), Co-PIs: R Knox, F Clarke, R DePauw, J Clarke, C Pozniak, I Wise, B Marchylo, L Schlichting. 2008. "Effect of the midge resistance Sml gene on durum wheat end use quality." Agriculture Development Fund (ADF). \$297,599. 2008-11. \$272,599 under AK Singh.
- 14 DePauw RM (PI), RE Knox, AK Singh, M Smith, FR Clarke, J Mitchell-Fetch. 2009. Midge Resistant Wheat Cultivars for Alberta. Alberta Crop Industry Development Fund (ACIDF). \$585,600. 2009-2012.
- 13 DePauw R (PI), RE Knox, AK Singh, FR Clarke, D Somers, JM Clarke. 2008. Enrichment of Desirable Gene Frequencies using Marker Assisted Selection. Western Grains Research Foundation (WGRF). \$220,000. 2009-2012.
- 12 DePauw R (PI), RE Knox, T Fetch, AK Singh, FR Clarke, JM Clarke. 2008. Incorporating resistance to Ug99 and Variants into Canadian wheat cultivars. Western Grains Research Foundation (WGRF). \$100,000. 2009-2011.

- 11 Singh AK (PI), R Knox, R DePauw, F Clarke, B McCallum, J Clarke. 2008. Accelerated Incorporation of Leaf Rust Resistance into Canadian durum. Western Grains Research Foundation (WGRF). \$110,000. 2009- 2011. Whole amount under AK Singh.
- 10 Clarke, JM, FR Clarke, RE Knox, RM DePauw (including AK Singh after August 2007 as replacement of JM Clarke). Development of Canada Western Amber Durum. Secan Association. \$240,000. 2006 – 2009. Whole amount under A.K. Singh.
- 9 Fox, S., et al. (including AK Singh after August 2007). Genetic enhancement of wheat that promotes consumer health and wellness, advances economic benefits for all stakeholders, and protects the sustainability of the Canadian agro-ecosystem. AAFC-WGRF CRADA. AAFC-Funded. \$24,486,471. 2005 – 2009. Funded. AK Singh's portion ~\$1,022,000.
- 8 Fox S, et al. (multiple including AK Singh after August 2007). Genetic enhancement of wheat that promotes consumer health and wellness, advances economic benefits for all stakeholders, and protects the sustainability of the Canadian agro-ecosystem. AAFC-WGRF CRADA. WGRF-Funded. \$10,740,000. 2005 – 2009. Funded. AK Singh portion was ~\$408,000 annually.
- 7 Knox RE, JM Clarke, FR Clarke, CJ Pozniak. 2006. Haplotype identification of major quality traits for marker assisted selection in durum wheat. AAFC matching Investment Initiative \$240,000. 3 years. (including AK Singh after August 2007 as replacement of JM Clarke).
- 6 Knox RE et al. (multiple including AK Singh after August 2007). 2006 Development and evaluation of tools and strategies to enhance wheat molecular breeding. AAFC-A-base. \$293,500. 2007 – 2011.
- 5 Clarke FR, RE Knox, JM Clarke, RM DePauw. 2006. Systematic analysis of the preharvest sprouting resistance quantitative trait to develop a practical tool for marker assisted selection in wheat. WGRF \$343k + \$343k AAFC-MII. 3 years. (including AK Singh after August 2007 as replacement of JM Clarke).
- 4 Fetch T, FR Clarke, JM Clarke, RM DePauw, SL Fox, D Gaudet, RJ Graf, G Humphreys, RE Knox, A Laroche, B McCallum, DJ Somers, J Thomas. 2006. Characterization, incorporation, and molecular marker development of rust resistance in Canadian wheat to protect against catastrophic losses. WGRF \$1,468k + \$1,468k AAFC-MII. 3 years. (including AK Singh after August 2007 as replacement of JM Clarke).
- 3 Knox RE, FR Clarke, JM Clarke, NP Ames, TN McCaig, RM DePauw, BL Beres. 2005. Mapping and QTL analysis to facilitate development of durum wheat with enhanced nutritional quality and food safety. WGRF/AAFC-MII \$870,000. 3 years. (including AK Singh after August 2007 as replacement of JM Clarke).
- 2 Singh AK (PI), RE Knox, FR Clarke, R DePauw, CJ Pozniak. 2008. Biofortification of durum wheat for enhancing its nutritional quality. Western Grains Research Foundation. \$310,500. 3 years. Approved at \$100,000. Project not undertaken due to reduced funding available.
- 1 Singh AK (PI), RE Knox, FR Clarke, RM DePauw, CJ Pozniak. 2008. Biofortification of durum wheat for enhancing its nutritional quality. AAFC-Matching Investment Initiative. \$310,753. 3 years. Conditional approval with approved funding to \$100,000 over three years to match WGRF approved contributions. Project not undertaken due to reduced funding available through partner.

**LIST OF INVENTIONS (CULTIVARS)****SUMMARY OF CULTIVAR UPTAKE BY FARMERS****(Commercial acres grown by farmers from 2014-2017 on cultivars developed or co-developed)**

Cultivar	2014 acres	2015 acres	2016 acres	2017 acres
AAC Bailey	1,649	3,262	857	1,096
AAC Brandon	3,197	325,214	1,164,189	2,284,911
AAC Congress	-	-	42	1,268
AAC Connery	-	124	2,724	35,553
AAC Current	1,776	10,849	36,808	25,658
AAC Durafield	-	-	360	-
AAC Elie	3,541	64,616	224,137	507,595
AAC Marchwell	130	2,242	54,791	16,295
AAC Penhold	748	9,023	218,667	366,769
AAC Raymore	3,334	55,004	114,866	107,082
AAC Redberry	-	-	-	1,214
AAC Ryley	2,858	17,112	40,307	21,399
AAC Spitfire	-	159	6,260	92,122
AAC Succeed	-	-	-	10
AAC Viewfield	-	-	133	5,131
AAC W1876	-	5,110	19,235	19,984
Brigade	435,869	548,300	602,432	397,365
Carberry	1,241,683	1,067,026	672,039	464,627
Enterprise	47,668	51,240	72,306	46,227
Eurostar	16,421	47,119	70,549	70,701
Muchmore	229,055	384,511	434,931	470,971
Transcend	232,553	596,784	1,058,093	1,227,393
<b>Total Acres (Year)</b>	<b>2,220,482</b>	<b>3,187,695</b>	<b>4,793,726</b>	<b>6,163,371</b>

Source: Canadian Grains Commission. Data web link: <https://www.grainscanada.gc.ca/statistics-statistiques/variety-variete/varieties-en.htm> (Publically accessible data)

**DETAILS OF CULTIVARS DEVELOPED**

- 36 DT881 durum wheat. Ruan et al. (including AK Singh). DT881 supported for registration at Prairie Recommending Committee for Wheat, Rye and Triticale (PRCWRT)<sup>1</sup>, 2018. Expected<sup>2</sup> contribution ~25% for cross development, early generation selection, development of pureline, pre-commercial testing.
- 35 DT878 durum wheat. Ruan et al. (including AK Singh). DT878 supported for registration by PRCWRT, 2018. Expected contribution ~25% for cross development, early generation selection, development of pureline, pre-commercial testing.
- 34 DT871 Ruan et al. (including **AK Singh**). – supported for registration PRCWRT, 2017. DT871 (AAC Succeed) durum wheat. Expected % contribution ~25% for cross development, early generation selection, development of pureline, pre-commercial testing.
- 33 HW388 Cuthbert et al. (including **AK Singh**). HW388 supported for registration by PRCWRT, 2017. Expected contribution: 4%.
- 32 BW980 Cuthbert et al. (including **AK Singh**). BW980 supported for registration by PRCWRT, 2016. Expected % contribution: 4%.
- 31 DT863 Ruan et al. (including **AK Singh**). – supported for registration at PRCWRT, 2016.

- Expected contribution ~25% for cross development, early generation selection, development of pureline, pre-commercial testing.
- 30 AAC Stronghold. Ruan et al. (including **AK Singh**) supported for registration by PRCWRT, 2016. Expected contribution ~25% for cross development, early generation selection, development of pureline, pre-commercial testing.
  - 29 BW968 Cuthbert et al. (including **AK Singh**). BW968 supported for registration by PRCWRT, 2016. Expected contribution: 4%.
  - 28 PT250 Cuthbert et al. (including **AK Singh**). PT250 supported for registration by PRCWRT, 2016. Expected contribution: 3%.
  - 27 AAC Congress DePauw et al. (including **AK Singh**). DT856 (= AAC Congress) supported for registration by PRCWRT, 2015. Expected contribution ~25%
  - 26 AAC Concord Cuthbert et al. (including **AK Singh**). BW963 (=AAC Concord) supported for registration by PRCWRT, 2015. Expected contribution: 4%.
  - 25 AAC Viewfield Cuthbert et al. (including **AK Singh**). BW965 (= AAC Viewfield) supported for registration by PRCWRT, 2015. Expected contribution: 4%.
  - 24 AAC Redberry Cuthbert et al. (including **AK Singh**). BW966 (=AAC Redberry) supported for registration by PRCWRT, 2015. Expected contribution: 4%.
  - 23 AAC W1876 Cuthbert et al. (including **AK Singh**). BW957 (= AAC W1876) supported for registration by PRCWRT, 2014. Expected contribution: 5%.
  - 22 BW961 Cuthbert et al. (including **AK Singh**). BW961 supported for registration by PRCWRT, 2014. Expected contribution: 5%.
  - 21 HW363 Cuthbert et al. (including **AK Singh**). HW363 supported for registration by PRCWRT, 2014. Expected contribution: 5%.
  - 20 AAC Connery Cuthbert et al. (including Singh, A.K.). PT245 (=AAC Connery) supported for registration by PRCWRT, 2014. Expected % contribution: 5%.
  - 19 AAC Spitfire durum wheat. DePauw et al. (including **AK Singh** at 25% contribution). DT844 (=AAC Spitfire) supported for registration by PRCWRT, 2014. AAC Spitfire durum wheat invention disclosure filed at AAFC.
  - 18 AAC Cabri durum wheat. DePauw et al. (including **AK Singh** at 25% contribution). DT840 (=AAC Cabri) supported for registration by PRCWRT, 2014. AAC Cabri durum wheat invention disclosure filed at AAFC.
  - 17 AAC Penhold wheat. Cuthbert et al. (including **AK Singh**). HY1319 (=AAC Penhold) supported for registration by PRCWRT, 2013. contribution: 6%.
  - 16 AAC NRG097 wheat. Cuthbert et al. (including **AK Singh**). GP097 (=AAC NRG097) supported for registration by PRCWRT, 2013. Expected contribution: 6%.
  - 15 AAC Marchwell durum wheat. **Singh AK** et al. (AK Singh contribution at 19%). DT833 (=AAC Marchwell) supported for registration by PRCWRT, 2013. AAC Marchwell durum wheat invention disclosure filed at AAFC.
  - 14 AAC Durafield durum wheat. **Singh AK** et al. (AK Singh contribution at 19%). DT832 (=AAC Durafield) supported for registration by PRCWRT, 2013. AAC Durafield durum wheat invention disclosure filed at AAFC.
  - 13 AAC Raymore durum wheat. **Singh AK** et al. (AK Singh contribution at 19%). DT818 (=AAC Raymore) supported for registration by PRCWRT, 2012. 'AAC Raymore durum wheat invention disclosure filed at AAFC.
  - 12 AAC Current durum wheat. **Singh AK** et al. (AK Singh contribution at 18%). DT813 (=AAC Current) supported for registration by PRCWRT, 2012. 'AAC Current' durum wheat invention disclosure filed at AAFC.
  - 11 AAC Elie wheat. DePauw, R.M. et al. (including **AK Singh** at 7% contribution). BW931 (=AAC Elie) supported for registration by PRCWRT, 2012. 'AAC Elie' Canada Western Red

- Spring wheat invention disclosure filed at AAFC.
- 10 AAC Brandon wheat. DePauw, R.M. et al. (including **AK Singh** at 7% contribution). BW932 (=AAC Brandon) supported for registration by PRCWRT, 2012. 'AAC Brandon' Canada Western Red Spring wheat invention disclosure filed at AAFC.
  - 9 AAC Ryley wheat. DePauw, R.M. et al. (including **AK Singh** at 7% contribution). HY1312 (=AAC Ryley) supported for registration by PRCWRT, 2012. 'AAC Ryley' Canada Prairie Spring wheat invention disclosure filed at AAFC.
  - 8 Transcend durum wheat. **Singh AK** et al. DT801 (=Transcend) supported for registration by PRCWRT, 2011. (AK Singh contribution at 15%). 'Transcend' durum wheat invention disclosure filed at AAFC.
  - 7 AAC Bailey wheat. Depauw, R.M. et al. (including **AK Singh** at 5% contribution). BW901 (=AAC Bailey) supported for registration by PRCWRT, 2010. 'AAC Bailey' Canada Western Red Spring wheat invention disclosure filed at AAFC.
  - 6 Enterprise durum wheat. **Singh AK** et al. DT787 (=Enterprise) supported for registration by PRCWRT, 2010. Contribution % not provided in document. 'Enterprise' durum wheat invention disclosure filed at AAFC.
  - 5 NGP10 wheat. Depauw, R.M. et al. (including **AK Singh** at 2% contribution). Supported for registration by PRCWRT, 2009. GP10 General Purpose wheat invention disclosure filed at AAFC.
  - 4 Muchmore wheat. Depauw, R.M. et al. (including **AK Singh** at 1.5% contribution). Supported for registration by PRCWRT, 2009. 'Muchmore' Canada Western Red Spring wheat invention disclosure filed at AAFC.
  - 3 Carberry wheat. Depauw, R.M. et al. (including **AK Singh** at 1.5% contribution). Supported for registration by PRCWRT, 2009. 'Carberry' Canada Western Red Spring wheat invention disclosure filed at AAFC.
  - 2 Eurostar durum wheat. Clarke, J.M. et. al. (including **AK Singh**; contribution % not provided in document). Supported for registration by PRCWRT, 2008. 'Eurostar' durum wheat invention disclosure filed at AAFC.
  - 1 Brigade durum wheat. Clarke, J.M. et. al. (including **AK Singh**; contribution % not provided in document). Supported for registration by PRCWRT, 2008. 'Brigade' durum wheat invention disclosure filed at AAFC.

<sup>1</sup> *The Prairie Recommending Committee for Wheat, Rye and Triticale (PRCWRT) evaluates candidate cultivars of wheat, and upon the request of the owner or designate, makes recommendations to the Variety Registration Office, Canadian Food Inspection Agency regarding the suitability of the candidate for registration in Canada.*

<sup>2</sup> *In few cases, breeder has not yet filed invention disclosure forms therefore % contributions are unavailable in these cases OR listed as per email from Dr. R. Cuthbert (bread wheat breeder, AAFC).*

*List of cultivars supported at PRCWRT can be assessed at PGDC.ca website. Visit for entire listing:*

[http://pgdc.ca/pdfs/wrt/WRT%20Recommendations%201959-Present\\_Feb\\_2016.pdf](http://pgdc.ca/pdfs/wrt/WRT%20Recommendations%201959-Present_Feb_2016.pdf)

#### **LIST OF INVENTIONS (NON-CULTIVARS)**

- 11- **Singh AK** et al. A0709-AB03 / A0709-BX05 / A0709-CT01
- 13 Specific trait: Ergot resistance. Invention disclosure at AAFC Filed March 2013.
- 10 **Singh AK** et al. A0623-FH03  
Specific trait: Ergot resistance. Invention disclosure at AAFC Filed March 2013
- 9 **Singh AK** et al. A0527-GG03D  
Specific trait: Ergot resistance. Invention disclosure at AAFC Filed March 2013
- 8 **Singh AK** et al. A0512-JC01C  
Specific trait: Ergot resistance. Invention disclosure at AAFC Filed March 2013
- 6-7 **Singh AK** et al. A0308-LF02A and A0308-QE02A



- 5 Specific trait: Ergot resistance. Invention disclosure at AAFC Filed March 2013  
**Singh AK** et al. A0262&AM050  
Specific trait: Ergot resistance. Invention disclosure at AAFC Filed March 2013
- 4 **Singh AK** et al. A0433-GW05  
Specific trait: Loose smut resistance. Invention disclosure at AAFC Filed March 2013
- 3 **Singh AK** et al. A0611-DZ03  
Specific trait: Pre-harvest sprouting resistance. Invention disclosure at AAFC Filed March 2013
- 2 **Singh AK** et al. A0520-HD04  
Specific trait: Pre-harvest sprouting resistance. Invention disclosure at AAFC Filed March 2013
- 1 **Singh AK** et al. A0318-FD\*04  
Specific trait: Pre-harvest sprouting resistance. Invention disclosure at AAFC Filed March 2013

### **Invention disclosures filed at AAFC**

## **SUMMARY OF PEER REVIEWED PUBLICATIONS**

### ***PEER-REVIEWED JOURNAL PUBLICATIONS (SOYBEAN): 2013 -current***

\* = corresponding author; # = my graduate student; \$ = my PDF

- 85 Nagasubramanian K, S Jones (#), **AK Singh**, S Sarkar\*, A Singh\*, B Ganapathysubramanian\*. 2018. Plant disease identification using explainable 3D deep learning on hyperspectral images. *Frontiers in Plant Sci.* (Revisions submitted).
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### **PEER-REVIEWED JOURNAL PUBLICATIONS (Wheat, Corn)**

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**LIST OF PEER REVIEWED FULL CONFERENCE PAPERS**

Engineering papers are commonly published in conferences with peer review (similar to agriculture sciences journal system). Paper #14-18 are engineering domain publications.

- 18 Gao T, H Emadi, H Saha, J Zhang, A Lofquist, A Singh, B Ganapathysubramanian, S Sarkar, **AK Singh**, S Bhattacharya. Navigation strategies for a multi-robot ground-based row crop phenotyping platform. Proceedings of the ASME 2018 Dynamic Systems and Control Conference DSCC2018-9096.
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- 14 Akintayo A, N Lee, V Chawla, M Mullaney, C Marett, **AK Singh**, A Singh, G Tylka, B Ganapathysubramanian, S Sarkar. An End-to-end Convolutional Selective Autoencoder Approach to Soybean Cyst Nematode Eggs Detection. Proceedings of the 22nd ACM SIGKDD Workshop on Data Science for Food, Energy and Water. (San Francisco, CA). 2016.
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- 7 Clarke FR, CJ Pozniak, JM Clarke, JE Dexter, RE Knox, TN McCaig, **AK Singh** (2009). Association mapping of semolina yield in diverse durum wheat germplasm. 4th International Wheat Quality Conference. Wheat Science: Challenges & Opportunities. In RN Chibbar and JE Dexter (eds) Wheat Science Dynamics: Challenges & Opportunities; Agrobios, Jodhpur,

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- 6 DePauw RM, T Fetch, CW Hiebert, DG Humphreys, RE Knox, CJ Pozniak, JB Thomas, **AK Singh**, R Graf, HS Randhawa, SL Fox, PD Brown, FR Clarke (2009). Sources of resistance to Ug99 and its variants in Canadian germplasm. Conference paper in Borlaug Global Rust Initiative Ug99 workshop Mar 17-20, 2009. Mexico. pp 171-178.
  - 5 **Singh AK**, RE Knox, FR Clarke, JM Clarke, DJ Somers, G Fedak, A Singh, R DePauw. (2008). Fusarium Head Blight QTL Mapping in Durum Wheat and *Triticum carthlicum* Sources of Resistance. In Proceedings of the 11th International Wheat Genetics Symposium, Brisbane, QLD, Australia, 24–29 August 2008. Vol. 3. Edited by R. Appels, R. Eastwood, E. Lagudah, P. Langridge, M. Mackay, L. McIntyre, and P. Sharp. Sydney University Press, Sydney, pp. 845–847.
  - 4 Pozniak CJ, S Reimer, T Fetch, JM Clarke, FR Clarke, D Somers, RE Knox, **AK Singh** (2008). Association mapping of Ug99 resistance in a diverse durum wheat population. In Proceedings of the 11th International Wheat Genetics Symposium, Brisbane, QLD, Australia, 24–29 August 2008. Vol. 3. Edited by R. Appels, R. Eastwood, E. Lagudah, P. Langridge, M. Mackay, L. McIntyre, and P. Sharp. Sydney University Press, Sydney, pp. 809-811.
  - 3 Clarke FR, JM Clarke, CJ Pozniak, DJ Somers, JE Dexter, RE Knox, S Reimer, TN McCaig, **AK Singh** (2008). Association mapping of semolina yield in diverse durum wheat germplasm. In Proceedings of the 11th International Wheat Genetics Symposium, Brisbane, QLD, Australia, 24–29 August 2008. Vol. 2. Edited by R. Appels, R. Eastwood, E. Lagudah, P. Langridge, M. Mackay, L. McIntyre, and P. Sharp. Sydney University Press, Sydney, pp. 485-487.
  - 2 Pozniak CJ, JM Clarke, **AK Singh**, J Thomas, G Fedak (2007). Progress in Fusarium head blight resistance breeding in Canadian durum wheat. pp. 47 - 50. Conference paper In Proc. 5th Canadian Workshop on Fusarium Head Blight. Winnipeg, Canada. 27-30 Nov. 2007.
  - 1 **Singh AK**, BG Rossnagel, GJ Scoles (2001). New sources of scald (*Rhynchosporium secalis* Davis) resistance for western Canadian barley. Proceedings of the ‘Soils and Crops 2001’, University of Saskatchewan. pp (150 – 156).

#### ARCHIVED PAPERS PUBLISHED ONLINE

1. Zhang J, AK Singh. Genetic control and geo-climate adaptation of pod dehiscence provide novel insights into the soybean domestication and expansion. 2018. arXiv:1808.00996.
2. Shook JM, L Wu, T Gangopadhyay, B Ganapathysubramanian, S Sarkar, AK Singh. 2018. Integrating genotype and weather variables for soybean yield prediction using deep learning. bioRxiv 331561; doi: <https://doi.org/10.1101/331561>.
3. Authors: Koushik Nagasubramanian, Sarah Jones, Asheesh K. Singh, Arti Singh, Baskar Ganapathysubramanian, Soumik Sarkar. 2018. Explaining hyperspectral imaging based plant Disease identification: 3D CNN and saliency maps. arXiv:1804.08831
4. Sambuddha Ghosal, David Blystone, Asheesh K. Singh, Baskar Ganapathysubramanian, Arti Singh, Soumik Sarkar. 2017. Interpretable Deep Learning applied to Plant Stress Phenotyping. arXiv:1710.08619
5. Koushik Nagasubramanian, Sarah Jones, Soumik Sarkar, Asheesh K. Singh, Arti Singh, Baskar Ganapathysubramanian. 2017. Hyperspectral band selection using genetic algorithm and support vector machines for early identification of charcoal rot disease in soybean. arXiv:1710.04681
6. Adedotun Akintayo, Nigel Lee, Vikas Chawla, Mark Mullaney, Christopher Marett, Asheesh Singh, Arti Singh, Greg Tylka, Baskar Ganapathysubramanian, Soumik Sarkar. 2016. An end-



to-end convolutional selective autoencoder approach to Soybean Cyst Nematode eggs detection. arXiv:1603.07834

## INVITED PRESENTATIONS

- 57 **Singh AK** (2018). “Cyber-Agricultural Systems” 9th Annual CPS PI Meeting, Alexandria, VA. Nov 15-16, 2018. Attended by ~35 people.
- 56 **Singh AK** (2018). “Skeptic to Believer: The ML journey of a plant breeder” Predictive Plant Phenomics Research Symposium, Ames, IA. Nov 9, 2018. Attended by ~60 people.
- 55 **Singh AK** (2018). “Plant Breeding Education in the new era” Federal University of Vicosa, Brazil. Oct 25, 2018.
- 54 **Singh AK** (2018). “Soynomics – Soybean Breeding in the Phenomics Era” Hermitage Research Center, Australia (Oct 9, 2018). Attended by ~ 75 people.
- 52- **Singh AK** (2018). “AI in PB: We are living in an exciting world” National Agriculture and  
53 Food Research Organization, Tsukuba, Japan. April 4, 2018. Two presentations given in Japan (Tsukuba and Memuro campus, NARO). Attended by ~ 25 people.
- 51 **Singh AK** (2018). “Building teams for scientific and breeding innovations” Engineering college, U.P., India. July 4, 2018. Attended by ~ 100 people.
- 50 **Singh AK** (2018). “Rootomics: When all the low hanging fruits are gone” IA Soybean Research Center, Ankeny, IA. Aug 24, 2018. Attended by ~ 30 people.
- 49 **Singh AK** (2018). “Robotics and AI driven scientific and breeding innovations” System’s Biology conference. Melbourne, Australia. May 17, 2018. Attended by ~ 150 people.
- 48 **Singh AK** (2018). “Plant Breeding: An Evolving Discipline in Big Data World” JST Big Data Symposium, Japan (January 16-17, 2018). Attended by ~ 75 people.
- 47 **Singh AK** (2017). “Data Driven Discoveries for Agricultural Innovation (D3AI): a Plant Breeder’s Perspective” 2017 Annual ASA-CSSA-SSSA Tri-Societies meeting. Tampa, FL. Oct 24, 2017. Attended by ~ 50 people.
- 46 **Singh AK** (2017). “Machine Learning and Phenomics for Vertical Farming” FFAR. The Crops in Controlled Environments event is being held at the IBM Thomas J. Watson Research Center. Nov 13, 2017. Attended by ~ 50 people.
- 45 **Singh AK** (2017). “Perfect beans in the 21st century: the who, what, and how of developing them?” Sept 11, 2017. World Soybean Research Conference. Event cancelled due to hurricane Irma.
- 44 **Singh AK** (2017). “Phenomics: another hype or something more?”, Soybean Breeder’s Workshop. Feb 14, 2017. Attended by ~ 150 people.
- 43 **Singh AK and KG Falk** (2017). “How Can We Use Genetic Diversity to Improve Soybean Production: Tapping the Hidden Potential Through Roots”, Iowa Soybean Association Research Conference. Feb 8, 2017. Attended by ~ 30 people.
- 42 **Singh AK** (2016). “Soybean Breeding Program at ISU”, RF Baker Center for Plant Breeding. Ames, November 2, 2016. Attended by ~ 20 people.
- 41 **Singh AK** (2016). “The role of soybean breeding program at ISU for interdisciplinary research”, RF Baker Center for Plant Breeding. Ames, November 2, 2016. Attended by ~ 100 people.
- 40 **Singh AK** (2016). “Integrating Image Analysis and Machine Learning to Decipher the Genetics of Iron Deficiency Chlorosis”, **16th Biennial Conference of the Molecular and Cellular Biology of the Soybean**, Columbus, OH, August 10, 2016. ~200 attendees (researchers from academia, government, private sector). Attended by ~ 150 people.
- 39 **Singh AK** (2016). “Advancing Soybean Breeding through Engineering partnerships.

- Invited presentation”, **Monsanto Company**, St. Louis, Missouri. May 23, 2016.  
Global presentation to Monsanto researchers. Attended by ~ 30 people (plus global view through online medium).
- 38 **Singh AK** (2016). Application of Machine Learning in Soybean Breeding. Invited speaker at the 2016 **R F Baker symposium** “Thinking outside the yield box: A look at sustainability, efficiency, nutrition, and tolerance”, Ames, IA. Mar 3, 2016. Attended by ~ 100 people.
- 37 **Singh AK** (2016). Digital phenotyping for gene discoveries and genetic enhancement . Conference on “Phenotypic prediction: Image acquisition and analysis.” **Iowa State University**. Feb 24, 2016. Attended by ~ 75 people.
- 36 **Singh AK** (2016) (with co-presenters R. Higgins and K. Parmley – graduate students with Singh). Phenomics and Genomics Assisted soybean breeding: finding ways to increase production per acre. 2016 Research conference organized by the **Iowa Soybean Association**. Feb 17, 2016. Attended by ~ 60 people.
- 35 **Singh AK** (2016). Soybean breeding. **Seed Science Center**, Ames, IA, Feb 8, 2016. Attended by ~ 25 people.
- 34 **Singh AK** (with co-presenters C. Lawrence-Dill, B Ganapathysubramanian. D3AI: Data-Driven Discovery for Agricultural Innovation. At the “Data driven science initiative workshop. **Iowa State University**, IA. Jan 27-28, 2016. Attended by ~ 50 people.
- 33 **Singh AK** (2015). Challenges and strategies for soybean breeding in a variable environment. Invited speaker at the VI International Symposium on Genetics and Breeding, October 8, 2015. Universidade Federal de Viçosa, Viçosa-MG, **Brazil**. Attended by ~ 200 people.
- 32 **Singh AK** (2015). Soybean breeding at ISU. Invited speaker at **Dow AgroSciences** (Webex). Aug 28. 2015.  
Audience included US and overseas soybean breeders at DOW. Attended by ~ 20 breeders.
- 31 **Singh AK** (2015). The use of modern tools to protect soybean yield. Invited speaker at **South Dakota State University**, Brookings. Nov 16. 2015.  
Audience included students and professors at SDSU. Attended by ~ 50 people.
- 30 **Singh AK** (2015). The search for interacting loci: A tale of breeder-pathologists collaborations. Invited speaker at **University of Wisconsin**, Madison. Apr 21, 2015.  
Audience included students and professors at UW-Madison (plant pathology and genetics). Attended by ~ 50 people.
- 29 **Singh AK** (2014). Breeding for disease and pest resistance. Presented at Department of Horticulture, **Iowa State University**. January 27, 2014.  
Audience included students and professors. Ames, IA. Attended by ~ 40 people.
- 28 **Singh AK** (2013). Soybean breeding: directions and vision. Invited presentation. Presented at **Iowa Soybean Association** Supply Committee, December 11, 2013. Audience included Iowa farmers serving on the supply committee of Iowa Soybean Association. Ankeny, IA. Attended by ~ 25 people.
- 27 **Singh AK** 2013. What plant breeders do when they encounter a pathogen or microbe? Invited presentation. Presented at Department of Plant Pathology and Microbiology, **Iowa State University**, November 12, 2013. Audience included students, technical staff and professors. Ames, IA. Attended by ~ 40 people.
- 26 **Singh AK** 2013. Why is plant breeding so interesting? Invited presentation. Presented at Soybean Pest Interaction Annual Research Meeting, **Iowa State University**. Tuesday, May 14, 2013. Audience included researchers and commodity group representatives interested in research on interactions of soybean pests and pathogens on soybean. Iowa State University, Ames, IA. Attended by ~ 50 people.

- 25 **Singh AK** 2012. Durum wheat cultivar development. July 25, 2012. **Saskatchewan Institute of Agrologists**. Presentation given to provincial agrologists to help them learn plant breeding principles and process. [Agrologist is synonymous to Agronomist]
- 24 **Singh AK** 2012. Canadian durum genetic enhancement. CIGI Oct 15, 2012. **Canadian International Grains Institute**. WebEx Talk given to an International client important to Canadian business.
- 23 **Singh AK** 2011. Plant Breeding and its role in Canadian agriculture. Oral presentation. 37th Grain Industry Overview Course from November 21-25, 2011. **Canadian International Grains Institute**.
- 22 **Singh AK** 2011. Canadian durum genetic enhancements. Invited lecture. **Canadian International Grains Institute**. Sept 26, 2011. WebEx Talk given to Algeria Group Metidji.
- 21 **Singh AK** et al. 2011. New in durum research. **Canadian Wheat Board**. CWB GrowerLink meetings. Acadia Valley, AB. March 24, 2011. Canadian Wheat Board producer meetings. Talk related to recent durum research, cultivars and production issues. Attended by ~60 individuals.
- 20 **Singh AK** et al. 2011. New in durum research: AAFC Durum breeding. **Canadian Wheat Board**. CWB GrowerLink meetings. Swift Current, SK. March 23, 2011. Talk related to recent durum research, cultivars and production issues. Attended by ~75 individuals.
- 19 **Singh AK** et al. 2011. New in durum research. **Canadian Wheat Board**. CWB GrowerLink meetings. Elrose, SK. March 22, 2011. Talk related to recent durum research, cultivars and production issues. Attended by ~30 individuals.
- 18 **Singh AK** et al. 2011. Breeding wheat varieties for the future to keep Canada competitive. 'Combine to Customer' Program **Canadian International Grains Institute**, Feb 7, 2011. Invited Webinar to Canadian producers and industry to discuss Canadian wheat breeding and progress.
- 17 **Singh AK** et al. 2011. Breeding wheat varieties for the future to keep Canada competitive. 'Combine to Customer' Program **Canadian International Grains Institute**, Jan 31, 2011. Invited Webinar to Canadian producers and industry to discuss Canadian wheat breeding and progress.
- 16 **Singh AK** et al. Durum varieties and breeding. Invited presentation at **Crops and Soils in the Southwest**. Dec 7, 2010.
- 15 **Singh AK** et al. Breeding for enhanced AMF-wheat compatibility. **ASA-CSSA-SSA** annual meeting, Long Beach, California. Part of special session "A Look below Ground-the Role of Soil, Water and Root Systems & Wide Hybridization."
- 14 **Singh AK** et al. Developing desirable durum wheat: challenges and progress. Invited Webinar lecture **Canadian International Grains Institute**. Aug 24, 2010. Talk for a Japanese business delegation.
- 13 **Singh AK** and C Hamel. "Development of wheat cultivars with the arbuscular mycorrhizal symbiosis in Canada" Invited co-lecture by Dr. A.K. Singh and Dr. C. Hamel. **COST870**, Evora, **Portugal**. July 5, 2010. Part of a special session by COST. Attended by world experts in AMF.
- 12 **Singh AK** et al. Plant breeding activities in durum wheat. Invited presentation at the South West AGM **Saskatchewan Institute of Agronomy**, March 25, 2010. Attended by ~20 Professional Agrologists.
- 11 **Singh AK** et al. Improvement in Canadian durum quality. Invited Webinar presentation for International durum miller group at **Canadian International Grains Institute**. Web-seminar CIGI miller group, March 15, 2010. Talk on quality traits to an international miller's delegation.

- 10 **Singh AK** et al. Improvements made in durum quality through plant breeding. Invited presentation at the Canadian Wheat Board's GrowerLink meeting. December 9, 2009. Taber, AB. Attended by ~50 producers.
- 9 Singh, AK et al. Progress made in durum wheat. Invited presentation at the Canadian Wheat Board's GrowerLink meeting. December 8, 2009. Swift Current, SK
- 8 **Singh AK** et al. Canadian Durum wheat. Invited presentation for International durum group at CIGI. August 5, 2009. The talk was delivered to an international audience comprised of stakeholders from Europe, Asia, Africa, Americas. Offered expenses paid.
- 7 **Singh AK**, RM DePauw. 'Research Station – SPARC Wheat Breeding'. Invited presentation at the Southwest Marketplace at Frontier Days, Swift Current, SK. June 26th, 2009. Audience included residents of Swift Current.
- 6 **Singh AK**, JM Clarke, RM DePauw. 'Durum Wheat Development at SPARC'. SIPA / ICDC 13th Annual Irrigation Conference. Dec 9th, 2008, Swift Current. Audience included researchers, extension person, and producers.
- 5 **Singh AK**., JM Clarke. 'Wheat breeding in Canada'. ITALMOPA (Italian Millers Program). CIGI. Winnipeg, MB. Sept 8, 2008. Audience included Italian millers, CIGI, CWB, and media.
- 4 **Singh AK**, JM Clarke. 'Durum Wheat breeding in Canada'. Invited presentation for 4th Japan Durum group. Canadian International Grains Institute. Winnipeg, MB. August 19, 2008. Audience included members of CIGI, CWB, media, and Japanese members involved in various aspect of durum production and processing. Offered expenses paid.
- \* **Singh AK**, JM Clarke. 'Durum varieties'. Invited presentation at "Croportunities" conference organized by Saskatchewan Agriculture and Food. Feb 13, 2008. Shaunavon, SK. Note – could not attend due to blizzard on Feb 13th morning. Presentation included information for grain producers on durum varieties.
- 3 **Singh AK**, JM Clarke. 'Durum wheat breeding program'. Invited by the Dean, College of Agriculture, G.B. Pant University of Agriculture and Technology, January 29th, 2008. Pantnagar, India.
- 2 **Singh AK**, JM Clarke. 'Durum varieties: Canada's durum program'. Invited by the Canadian Wheat Board. "Durum Challenge" 2007, Dec. 18, Palliser Pavilion, Kinetic Park, Swift Current, Canada. Provided details on the durum breeding methodologies and cultivar development progress. Audience included ~250 durum producers.
- 1 **Singh AK**. Physiogenetic modeling of maize grain yield. Oral presentation in First Annual Plant Sciences Scholarship Conference, Pioneer Hi-Bred International Inc., Iowa, 2003.

**SUMMARY OF RESEARCH ADVISING**

- **Total Undergraduates:** >30 paid undergraduate hourly employees since 2014; Two under mentorship through a research fellowship awarded on a competitive basis, department of Agronomy.
- **Total M.S.:** Six (3 on-campus; 3 on-line); 5 graduated
- **Total PhD:** Eight; 2 graduated [# includes one MS student who defended on Aug 8, 2016, and continued as a PhD student]
- **Total Post-Doctoral:** Seven (four at ISU, three in previous position at AAFC)
- **Total Professional and Scientific staff at ISU:** Six (Brian Scott, Jennifer Hicks, William Doepke, Jiaoping Zhang, Jeffry Clawson; previously – Jae Brungardt from 2014-2018)

**GRADUATE STUDENT ADVISING AT IOWA STATE UNIVERSITY**

No.	Name	Degree	Major	Conferred	Employer
1	Ms. M. Ibore	PhD*	Interdepartmental Genetics and Genomics (IG2)	2017	Grand View University
2	Mr. R. Higgins	PhD	Plant Breeding	2018	PanAmerican Seed
3	Mr. K. Falk	PhD	Plant Breeding	In Progress (2015-)	-
4	Mr. J. Shook	PhD	Plant Breeding (Specialization: P3)	In Progress (2016-)	-
5	Mr. K. Parmley	PhD	Plant Breeding	In Progress (2016-)	Bayer
7	Mr. M. Carroll	PhD	Plant Breeding	In Progress (2017-)	-
8	Mr. C. Carley	PhD	IG2 (Specialization: P3)	In Progress (2017-)	-
9	Ms. Mariana Chiozza	PhD*	Crop Production and Physiology	In Progress (2018-)	-
10	Ms. T. Moellers	MS	Plant Breeding	2016	Beck's Hybrid
11	Mr. K. Parmley	MS	Plant Breeding	2016	Enrolled in PhD
12	Ms. S. Jones	MS*	Plant Breeding	2017	Texas A and M

**MS Plant Breeding Online student (Creative component)**

9	Mr. J. Wood	MS	Plant Breeding	2015	Pioneer Hybrid
10	Mr. R. Swinger	MS	Agronomy	In Progress (2014-)	-
11	Ms. Ashely Saunders	MS	Plant Breeding	2016	-

\* co-major professor

**POST-DOCTORAL FELLOW ADVISING**

No.	Name	Duration	Current Employer
1	Dr. Xinyi Xu	2017–18	ISU (education)
2	Dr. T. Mamo	2013–16	USDA-ARS
3	Dr. J. Zhang	2014–17	ISU
4	Dr. R.V.C Reddy	2015–17	USDA-ARS
5	Dr. M Pandey	2011–13	Assoc. Professor, Agriculture and Forestry Univ, Nepal
6	Dr. O. Ellouze	2011–13	Research Scientist, Alberta Agriculture and Rural Development, Canada
7	Dr. J. Isidro	2011–12	Assist. Professor, University College Dublin, Ireland

**VISITING SCHOLARS (Phd)**

(&gt; 11 MONTHS TERM)

No.	Name	Duration	Current Employer
1	Mr. L. Piexoto	2015-16 (11 months)	Bayer
2	Ms. S. Coser	2015-16 (11 months)	Bayer

**SERVICE ON GRADUATE PROGRAM OF STUDY COMMITTEE**

No.	Name	Degree	Major	Conferred	Current Employer
1	Daniel Kolhase	PhD	Plant Breeding	In Progress	
2	Souvik Banerjee	PhD	Material Sciences	In Progress	-
3*	Therin Young	PhD	Mechanical Engineering	In Progress	-
4	M. Dzievit	PhD	Plant Breeding	In Progress	-
5	V. Mirnezami	PhD	Mechanical Engineering	In Progress	-
6	H. Trentin	PhD	Plant Breeding	In Progress	-
7	H. Trumpy	PhD	Plant Breeding	In Progress	-
8	Lin Ma	PhD	Material Science and Engineering	In Progress	-
9	A. Akintayo	PhD	Mechanical Engineering	Fall' 16	Intel
10	J. Cameron	PhD	Plant Breeding	Fall' 16	Forage Genetics Intl.
11	C. McCabe	PhD	Plant Breeding	SS' 16	USDA-ARS
12	E. Lerch	PhD	Plant Pathology	SS' 16	ISU
13	X. Philips	MS	Plant Pathology	SS' 16	PhD student, ISU
14	S. Prichard	MS	Entomology	Spring' 16	-
15	D. Sanchez	PhD	Plant Breeding	Fall' 16	-
<b>External to ISU</b>					
15	Megan Mccaghey	PhD	University of Wisconsin	In Progress	-

\* Not yet officially signed on the POSC form

### ***UNDERGRADUATE RESEARCH FELLOWSHIP MENTORING***

Matt Carroll, Agronomy major at Iowa State University (2015-16); Mr. J. Ziggafos, Agronomy major at Iowa State University (2014-15). Students get to work on challenging breeding and research questions and lead their own project, as well as participate on graduate student projects and assist in the breeding program to gain useful experience for future career success.

### ***UNDERGRADUATE RESEARCH ADVISING (ENGINEERING STUDENTS)***

A.K. Singh is part of a group of three researchers (faculty members in Agronomy and Mechanical Engineering) who are working with engineering students (~6 to 30 students in different semesters) on CAPSTONE design projects. Capstone Design is the culmination of undergraduate students' study in their chosen engineering discipline and is a required course. Students gain hands-on experience with projects that have real-world applications. Singh et al. are working on robotic systems (phenotyping platforms) that are being developed to gain breeding efficiencies.

### ***OTHER MENTORING***

Served as a Breeder specialist for the Monsanto's Beachell-Borlaug International Scholars program at Monsanto (Ankeny, IA, Oct 14, 2014). Participants included ~20 student scholars.

### **CLASSROOM TEACHING AT IOWA STATE UNIVERSITY**

#### **2013-present AGRON 522 Field Methods in Plant Breeding (Alternate summer; 2 credits)**

- 13 students in 2013; 6 students in 2015, 8 students in 2017

Year	Overall rating of this instructor	Overall rating of this course	Overall rating of this instructor's teaching effectiveness
2013	4.0	3.6	4.0
2015	4.8	5.0	4.8
2017	5.0	5.0	4.8

Scale: 1 = Very Poor, 5 = Very Good

#### **2014-present AGRON 521 Principles of Cultivar Development (Fall, 3 credits)**

- Course material prepared by A.K. Singh for 2014 fall delivery.
- Fall 2014 included 8 (MS and PhD), Fall 15 included 15 (UG, MS, PhD) from Agronomy, Plant Pathology and Microbiology, GGCB, IGG. Fall 16 included 10 students.

Year	Overall rating of this instructor	Overall rating of this course	Overall rating of this instructor's teaching effectiveness
2014	4.7	4.7	4.3
2015	4.5	4.5	4.2
2016	4.9	4.9	4.8
2017	4.8	4.5	4.5

Scale: 1 = Very Poor, 5 = Very Good

### **CLASSROOM TEACHING AS GRADUATE TEACHING ASSISTANT**

- **2003 – 2004 and 2005: Graduate Teaching Assistant**, University of Guelph, Canada  
Organization and preparation of lab sessions including lecture preparations and delivery, report and assignment evaluations for a 2<sup>nd</sup> year course to introduce Plant Agriculture AGR2451/2 and AGR2470 (Anatomy, Morphology, Agronomy, Physiology, Genetics, Biotechnology).
- **2000 – 2001: Teaching Assistant**, University of Saskatchewan, Canada  
Research, designing of experiments, and conduct laboratories for two 4<sup>th</sup> year courses (Plant Biotechnology PL SC 416.3 and Plant Physiology PL SC 417.3)

### **INSTRUCTIONAL MATERIALS PREPARED (EXTERNALLY DELIVERED)**

Crop Improvement Course for the Bill and Melinda Gates funded project on course/curriculum development for African University (Funded at ISU)

(§) = Post Doctoral Fellow with AK Singh

Course Modules (Chapters) prepared and delivered (peer-reviewed)

1. **Singh AK**, J Barb, A Singh. Module 1: Basic Principles of plant breeding.
2. **Singh AK**. Module 2: Pedigree Naming systems and symbols for designating generations.
3. **Singh AK**, A Singh, J Barb. Module 3: Genetic variation and germplasm usage.
4. **Singh AK**. Module 4: Refresher on population and quantitative genetics.
5. **Singh AK**. Module 4-1: Concepts on minimum population sizes and starting generation to select.
6. **Singh AK**. Module 4-2: Artificial selection.
7. **Singh AK**, A Singh. Module 5: Steps in cultivar development.
8. **Singh AK**, A Singh. Module 6: Breeding methods.
9. Mamo T (§), **AK Singh**. Module 7: Participatory Plant Breeding and Participatory Varietal Selection.
10. Mamo T (§), A Singh, **AK Singh**. Common bean crop module.
11. Singh A, T Mamo, **AK Singh**. Cowpea Crop module.
12. Mamo T (§), **AK Singh**. Millet crop module.
13. Singh A, **AK Singh**. Rice Crop module.
14. Mamo T (§), **AK Singh**. Sorghum Crop module.
15. Mamo T (§), **AK Singh**. Seed Systems and Certification.

Applied Learning Activity (ALA) prepared and delivered:

1. Singh A, **AK Singh**, J Derera, P Tukamuhabwa, J Barb, P Gibson. ALA1: Breeding objectives.
2. Singh A, **AK Singh**, J Derera, P Tukamuhabwa, J Barb. ALA2: Material transfer agreement.
3. **Singh AK**, J Derera, A Singh, P Tukamuhabwa, J Barb. ALA3: Quantitative and qualitative traits.
4. **Singh AK**, J Derera, A Singh, P Tukamuhabwa, J Barb. ALA4: Genotype x Environment interactions.
5. Tukamuhabwa P, J Derera, **AK Singh**, A Singh, J Barb. ALA5: Participatory plant breeding #1.
6. Tukamuhabwa P, J Derera, **AK Singh**, A Singh, J Barb. ALA6: Participatory plant breeding #2.
- 7-13. **Singh AK**, A Singh. ALA13: Cultivar Development#1-7.

\*ALA13-19 are identical but directed towards different crops.



## TEACHING WORKSHOP PARTICIPATION

2014 Project Learn (*Introduction to Learning-Centered Classes and Meetings*)

Two full day course. Through this workshop, I gained an understanding on specific learning and teaching theories, practical idea to implement in a classroom and course, gained insight about student mental processing. New strategies were learned on thinking and reasoning, and content retention, and develop plans to use learning-centered activities with learners. These were applied in AGRON521 successfully.

## UNDERGRADUATE DEGREE ADVISING

AK Singh currently serves as an academic advisor to 7 Agronomy undergraduate students (8 have graduated). Azucena Castillo, Cale Gent, Madeline McMullen (changed Majors in F'18), Kyle Miller, Jesse Nate, Jacob Ratzke, Wyatt George  
Graduated: Jake Ziggafos, Warren Bailey, Matthew Carroll, Brent Pekelder, Timothy Riessen, Aliana Stevenson, Adam Guy, Allison Heister.

## TECHNOLOGY TRANSFER SERVICE, IN MEDIA

1. New research could help diagnose soybean stresses with a smartphone (2018). <https://seedworld.com/new-research-help-diagnose-soybean-stresses-smartphone/>
2. Diagnose crop disease with a smartphone (2018). <https://www.futurity.org/crop-disease-smartphone-1742032-2/>
3. Soy think tank filled with research ideas (2017). <https://www.iasoybeans.com/news/articles/soy-think-tank-filled-with-research-ideas/>
4. Studying the Genetic Diversity that Lies Beneath (2017). <https://stories.cals.iastate.edu/2017/12/studying-genetic-diversity-lies-beneath/>
5. Researchers propose new data systems to quickly spot, stop the spread of crop plant diseases. VPR Magazine. <https://www.vpresearch.iastate.edu/e-news-researchers/2017-newsletters/july-5-newsletter-2/>
6. Mechanical engineering and agronomy researchers team up to study robotics in agriculture. 2017. <https://www.predictivephenomicsinplants.iastate.edu/mechanical-engineering-and-agronomy-researchers-team-study-robotics-agriculture>
7. Genetic Diversity key to improving soybeans. (2017). <https://www.iasoybeans.com/news/articles/genetic-diversity-key-to-improving-soybeans/>
8. Iowa Soybean Association Funds More Than \$2 Million in Research at Iowa State University This Year. (2016). <https://www.cals.iastate.edu/news/releases/iowa-soybean-association-funds-more-2-million-research-iowa-state-university-year>
9. Iowa State University Research Finds Genetic Basis for Resistance to Sudden Death Syndrome in Soybeans. (2016). <https://www.cals.iastate.edu/news/releases/iowa-state-university-research-finds-genetic-basis-resistance-sudden-death-syndrome>
10. Iowa State University research finds genetic basis for resistance to sudden death syndrome in soybeans (2016). [http://www.hpj.com/general/iowa-state-university-research-finds-genetic-basis-for-resistance-to/article\\_a5d336a8-7a95-55ab-be19-a75fe4e9f8.html](http://www.hpj.com/general/iowa-state-university-research-finds-genetic-basis-for-resistance-to/article_a5d336a8-7a95-55ab-be19-a75fe4e9f8.html)
11. Canadian Scientist to Join Iowa State as Monsanto Chair in Soybean Breeding (2013). <https://www.cals.iastate.edu/news/releases/canadian-scientist-join-iowa-state-monsanto-chair-soybean-breeding>
12. More than 20 media interviews (print, radio) from 2007 – 2014. Most popular press articles in leading agriculture magazine featuring Singh's work

- “A Short history of durum wheat breeding” by Andrea Hilderman. Story in ‘Grainews’ a leading agriculture magazine. Published Nov 26, 2014.
  - “Innovation in Durum” by Andrea Hilderman. Story in ‘Top Crop Manager’ a leading Canadian agriculture magazine. Published March 2014.
  - “Fungus-Powered Performance” by Carolyn King. Story in ‘Top Crop Manager’ a leading Canadian agriculture magazine. Published October 2013.
  - “A Solid Stem in Durum Breeding” by Sarah Weigum. Featured story in ‘Grainews’ a leading Canadian agriculture magazine. Published March 2013.
  - “New durum varieties move closer to market” by Brian Cross. Story in ‘The Western Producer’ a leading Canadian agriculture magazine. Published January 2013.
  - “Solid-Stemmed Durum Nearing Commercial Release”. Story in ‘2013 SASKSEED GUIDE’ an annual Provincial Seed Guide. Published 2013.
  - “Experts Seek to Improve Plants’ Ability to Capitalize on Beneficial Organisms” by Dan Yates. Story in ‘The Western Producer’ a leading Canadian agriculture magazine. Published October 2012.
  - “New Solid Stem Durum Line Latest Weapon in Sawfly War” by Brian Cross. Story in ‘The Western Producer’ a leading Canadian agriculture magazine. Published March 2012.
  - “Durum leads Class of Potential New Crops” by Brian Cross. Story in ‘The Western Producer’ a leading Canadian agriculture magazine. Published March 2012.
  - “Summer Research Days” by Leeann Minogue. Story ‘Grainews’ a leading Canadian agriculture magazine. Published September 2012.
  - “Crops Research Focused on Prairie Competitiveness” by Leeann Minogue. Story in ‘Country Guide’ a leading Canadian agriculture magazine. Published online July 2012.
  - “Durum Breeding for FHB Resistance” by Carolyn King. Story in ‘Top Crop Manager’ a leading Canadian agriculture magazine. Published February 2011.
  - “Enterprise Durum Beams Down” by Lyndsey Smith. Story ‘Grainews’ a leading Canadian agriculture magazine. Published online November 2009.
13. Provided expert opinion to queries from wheat producers for their on-farm production issues, when contacted by them. Technology transfer for durum cultivars. On average, provided information to 2 producers per month over the phone with higher call frequency during crop season for on-farm issues. These calls were generally from farmers in South-West SK and few in South-East AB). 2007 – 2013.
  14. Provided information to Canadian Grains International Institute on breeding program and pipeline. 2009-2013.
  15. Radio interviews given to Goldenwest Radio on durum crop update and SPARC’s durum breeding program. 2007, 2008, 2009, 2010.
  16. Newsprint interview, Grain News and Country Guide. 2009
  17. Provide expert opinion to queries from Agriculture Knowledge Centre (SK provincial government establishment – resource for producers to phone and gather relevant information on production issues).
  18. Provide information to the Crop Development Specialist, Saskatchewan Ministry of Agriculture on durum varieties and research.
  19. Provide information on durum varieties to Lethbridge Inland Terminal (who were approached by durum producers).

## **TOUR HOSTED**

- More than 80 national and international audience tours hosted (2007 – 2017) (Canterra Seeds, Agriculture Development Fund, Alliance Seed Corporation, American Italian Pasta Company, Arvalis – France, Australian Grains Magazine, Barilla America, Canadian International Grains Institute International visitors (numerous), Canadian Wheat Board, FP Genetics, GRDC – Australia, Green Key Solutions, Iowa Soybean Association, Limagrain, Monsanto Company, Myllyn Paras Ltd Finland, National Institute for Agricultural Research and University of Chile, New World Pasta, Plant and Food Research – NZ, Prairie West Terminal, Pulse Breeding Australia, Secan Association, SK Ministry of Agriculture, South West Terminal, United Soybean Board, Viterra, Westbred Inc, Western Grains Research Foundation).
- Mentored graduate students to help organize the 2018 R F Baker Annual Plant Breeding Field day.

## **COMMITTEE MEMBERSHIPS, EXPERT PANELS, ADVISORY COMMITTEES**

- 38 First International Workshop on Machine Learning for Cyber-Agricultural Systems, IIT Bombay, India, 2018.
- 37 International Advisory Committee, AFITA/WCCA, Research Frontiers in Precision Agriculture, 2018.
- 36 Invited Faculty speaker at the ISU's "Managing and Supporting Staff" session. Apr 9, 2018.
- 35 Session chair, International Plant Phenotyping Symposium, Adelaide, Australia. 2018.
- 34 Department Review Committee, Agronomy. 2018. (helped write research report, presented on graduate program education in the department.
- 33 Co-organizer, Digital Agriculture booth, Agronomy@ISU, Farm Progress Show. 2018.
- 32 Session chair, digital agriculture, 2018 Midwest West Big Data summer school.
- 31 Member, Agronomy Strategic Planning Committee
- 30 Member, Agronomy Farms Advisory Committee
- 29 TEconomy report. Biosciences Innovation Strategy for Iowa. 2017.
- 28 Panelist, New Faculty Orientation Panel at ISU, 2017
- 27 Participation in Commercialization Manager hiring at ISU, 2018
- 26 Member, NCERA-TEMP137, Soybean Diseases, in the National Information Management and Support System (2014 - )
- 25 Chair, Soybean Breeders workshop General Session (2014)
- 24 Associate Editor, Canadian J Plant Sci (2013 - 15)
- 23 Member, Selection Committee for Soybean Geneticist position USDA-ARS, 2013
- 22 Diversity in Agronomy, Crops, Soils, and Environmental Sciences Committee. ASA-CSSA-SSSA. 2011-13
- 21 External thesis examiner: University of Saskatchewan, 2012. Student name: Yong Liu. Thesis title: Characterization of Mycosphaerella blight resistance, lodging resistance, and micronutrient concentration in a field pea recombinant inbred line population.
- 20 Member, National Advisory Committee, 1st Canadian Wheat Symposium. 2012.
- 19 Member, Prairie Recommending Committee for Wheat, Rye and Triticale (PRCWRT) of PGDC. 2008 – 2013
- 18 Member, Breeding and Agronomy evaluation team (AET) of PRCWRT, PGDC. 2008 – 13
- 17 Member, Saskatchewan Advisory Committee on Grain Crops. 2007 – 13
- 16 Durum Crop Coordinator, PRTWRT, PGDC. 2008 – 13
- 15 Secretary and Treasurer, Prairie Grain Development Committee (PGDC). 2009 – 12

- 14 Secretary, Canadian Wheat Improvement Network (CWIN). 2008 – 10.
- 13 Member, International Crop Science Committee, Crop Science Society of America, 2006 – 08.
- 12 Practising Professional Agrologist (Saskatchewan Institute of Agrologists).
- 11 Official plant breeder recognition (CSGA)
- 10 Member, Request for proposal evaluation committee for grant of marketing rights to AAFC durum cultivars. 2008 – 2012.
- 9 Member, SPARC's Seminar committee. 2008 – 2010
- 8 Member, SPARC's Science Communication committee, 2010 - 2012
- 7 Member, National Advisory Committee, 1st Canadian Wheat Symposium. 2012.
- 6 Member, Saskatchewan Young Professionals and Entrepreneurs. South-West Branch.
- 5 Member, Selection committee – research scientist and several technician positions hiring. Canadian Federal Government (AAFC). 2008 – 2013.
- 4 Vice President, Department of Plant Sciences Graduate Student Committee, 2000 – 01.
- 3 Treasurer, Department of Plant Sciences Graduate Student Committee, 2000 – 01.
- 2 Member, Graduate Student Association Bursary Committee, 1999 – 00.
- 1 Member, Course Council, Graduate Student Association, 1999 – 00.

### **JOURNAL SERVICE**

- Associate Editor, Science Plant Phenomics (2018 - )
- Associate Editor, Can J Plant Sci. (2013-15)
- Expert reviewer for: Advances in Space Research, BMC Plant Biology, Cereal Research Communication, Canadian Journal of Plant Science, Crop Science, Grassland Science, GigaScience, Molecular Breeding, Plant Disease, Sensors, Theoretical and Applied Genetics

### **RESEARCH PROPOSAL REVIEWS (referee/reviewer service)**

(since 2010)

- USDA-AFRI
- Canadian Field Crop Research Alliance.
- Canadian National Wheat Cluster (Twice).
- Iowa State University (Internal grant reviewer) (Twice).
- Natural Scientific and Engineering Research Council, Canada.
- Agriculture and Agri-Food Canada, Canada.
- Ontario Ministry of Agriculture, Food and Rural Affairs, Canada (Twice).
- Alberta Crop Industry Development Fund Ltd. (TWO Grant submissions reviewed), Canada.
- Agriculture Council of Saskatchewan Inc., Canadian Agricultural Adaptation Program (CAAP).
- Israel Science Foundation.

### **PROFESSIONAL DEVELOPMENT**

- Team Science Academy
- Energize your leadership process

### **SOCIETY MEMBERSHIPS**

- American Society of Agronomy
- Crop Science Society of America
- National Association of Plant Breeders.

## **LIST OF SCHOLARSHIPS/FELLOWSHIPS**

(AS A STUDENT)

- 12 PDF: Visiting Fellowship Canadian Government Laboratory Research award, National Scientific and Engineering Research Council of Canada, Successful candidate on inventory list
- 11 Ph.D.: Pioneer Hi-bred Plant Breeding Scholarship (\$18000/year – 4 years).
- 10 Ph.D.: Silas Smith Memorial Graduate Scholarship (\$3500).
- 9 Ph.D.: Pride Brand Seeds Scholarship (\$1500).
- 8 Ph.D.: University Graduate Scholarship (\$2000).
- 7 Ph.D.: Kasha scientific travel fund (\$400)
- 6 Travel award to attend maize Genetics conference
- 5 Ph.D.: Mary Edmunds Williams Scholarship (\$5000/year – 2 years).
- 4 M.Sc.: Roderick Alan McLean Post Graduate Scholarship in Crop Sciences (\$6000)
- 3 M.Sc.: Graduate Teaching Assistantship (\$3000).
- 2 M.Sc.: P.F. Knowles and Dorothea Goodale Post Graduate Scholarship in Crop Sciences (\$7000).
- 1 B.Sc.: University Merit Scholarship (4 years).