Introduction

The Southern Agricultural Research Center (SARC) near Huntley, Montana, is one of seven facilities that make up the Montana Agricultural Experiment Station (MAES) Research Center System. Established by the Montana Legislature in 1893, the mission of the Montana Agricultural Experiment Station, as defined by state statute, is "to conduct and promote studies, scientific investigations and experiments relating to agriculture, natural resources and rural life and to diffuse information thereby acquired among the people of Montana". The Montana Agricultural Experiment Station fulfills this mission as the agricultural research component of Montana State University-Bozeman's Federal Land Grant responsibilities for teaching, research and extension. The mission of the Research Center System is to serve the specific needs of the clientele in local production areas, and the broader needs of Montana agriculture in general, through applied research directed to the problems and impacts of agricultural production.

To fulfill these missions, the Southern Agricultural Research Center conducts agronomic research and education programs for agriculture in the dryland and irrigated areas located in nine counties of south central Montana (Fig. 1). This report contains information gathered from research trials conducted at the Southern Agricultural Research Center and in the surrounding counties during the 2004 calendar year. The purpose of this document is to summarize and disseminate the work accomplished by the annual activities of the Southern Agricultural Research Center’s faculty and staff.

Approximately 45 agronomic field experiments were conducted by the Southern Agricultural Research Center personnel during the 2003-2004 cropping season. The experiments cover variety and germplasm testing, cropping systems and alternative crop evaluations. These studies are condensed into the progress reports that comprise most of this publication. Most experiments are continuing projects and the interpretation of this information may change with the collection of additional data. The accumulation of this agronomic research information is the beginning of what will eventually become several individual and more substantial publications.

Funding and Support

State of Montana Funding

The Southern Agricultural Research Center is an administered unit of the Montana Agricultural Experiment Station (MAES), and as such, is allocated a portion of the funds dispersed to the MAES by the Montana State Legislature on a biennium basis. Allocations of state funds to SARC for the current and past fiscal years (FY) are presented in Table 1. The FY2005 allocation represents a 5.3 percent increase and 5.7 percent reduction in funds to the research center compared to the FY2004 and FY2003 allocations, respectively.

Table 1. State-funded MAES allocations to SARC for FY2003 through FY2005.

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>FY2003</th>
<th>FY2004</th>
<th>FY2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries</td>
<td>$224,618</td>
<td>$207,596</td>
<td>$205,788</td>
</tr>
<tr>
<td>Labor</td>
<td>0</td>
<td>0</td>
<td>15,000</td>
</tr>
<tr>
<td>Operations</td>
<td>42,200</td>
<td>42,200</td>
<td>42,200</td>
</tr>
<tr>
<td>Capital Equipment</td>
<td>0</td>
<td>0</td>
<td>12,000</td>
</tr>
<tr>
<td><strong>Total Allocation</strong></td>
<td><strong>$278,818</strong></td>
<td><strong>$249,796</strong></td>
<td><strong>$262,988</strong></td>
</tr>
</tbody>
</table>

1/ Fiscal years begin July 1st and terminate on June 30th the following calendar year.

Extramural Funding

In 2004, the Agronomy program at SARC received $86,283 in extramural funding of research through grants and contracts. Organizations and private companies that
contributed grant or contract funds and/or other gifted resources include:

- Arizona Plant Breeders
- BASF
- Bayer CropScience
- Busch AG
- Beta Seed Company
- Coors Brewing Company
- E.I. du Pont de Nemours and Company
- Garst Seed Company
- General Mills
- Hyland Seeds
- Interstate Seed Company
- Kaystar Seeds
- Kussmaul Seed Company
- Monsanto Company
- Montana Wheat and Barley Committee
- Mycogen Seeds
- Seedex Inc.
- Syngenta Crop Protection Inc.
- Syngenta Seed Inc.
- USDA Special Grants: Four-State Ruminant Consortium
- USDA Special Grants: Montana Institute for Biobased Products
- Western Plant Breeders
- Western Sugar Cooperative Research Committee

**SARC Faculty and Staff**

Current staff includes one tenure-track faculty positions; two support scientists; a farm foreman; and one part-time administrative assistant. The following individuals are the current faculty and staff at the station:

- Dr. Kenneth D. Kephart (February 1, 1998)
  Associate Professor of Agronomy and Superintendent (kephart@montana.edu)

- Mr. Tom A. Fischer (February 1, 1998)
  Research Specialist and Farm Foreman (tfischer@montana.edu)

- Mrs. Tammy L. Balzer (May 15, 2000)
  Administrative Assistant (tbalzer@montana.edu)

- Dr. Qasim A. Khan (May 1, 2002)
  Post Doctoral Fellow in Plant Breeding (qkhan@montana.edu)

- Dr. Geraldine B. Opena (December 1, 2002)
  Research Associate - Agronomy (gopena@montana.edu)

Dr. James “Mick” Mickelson resigned as Assistant Professor of Weed Science effective February 1, 2004, and relocated to central Iowa where he is currently employed by Pioneer Hibred International. Ms. Nicole Flowers resigned as Research Associate of Weed Science effective July 16, 2004, to pursue a career in public teaching. Both individuals were excellent scientists and made numerous contributions to agricultural research in south central Montana. A search has been initiated to refill the vacancy created by Dr. Mickelson’s departure.

**Capital Equipment Acquisitions**

Capital equipment funds for FY2004 and FY2005 were eliminated from the MAES budget by the 2003 Montana Legislature. No allocation of state funds was received by SARC for capital item purchases during the 2004 calendar year.

**Physical Plant Improvement**

In November, 2003, SARC received authorization from the MAES Director to proceed on the design, development and construction of a new 5,550 square foot office/laboratory building to replace modular units leased by the research center since 1998. Estimated cost, including new water and septic systems, is $650,000. One half of the funds for the new building were provided by the 2001 Montana State Legislature from the state’s long term building bond fund. The remaining funds have been provided by public and private donations to the MAES Million Dollar Match Fund. The new building has been designed and will be constructed under the direction of Mr. Scott Atwood, Atwood Architecture, Billings, Montana. Official ground breaking for the new facility occurred during the Field Day on July 6, 2004. Construction was initiated on November 16, 2004 with completion of the new office building expected in late April or early May 2005.

Construction of this facility was made possible through the generosity of many individuals, public organization and private companies that contributed to the MAES Million Dollar Match Fund (by category):

**Founder ($100,000+):**

- Burlington Northern Santa Fe Foundation
- Paul and Barb Grieco – Bozeman
- National Association of Wheat Growers Foundation

**Leader ($10,000+):**

- Bayer CropScience LP
- Big Horn County Sugar Beet Growers Association
- Carbon County Commission
- Coors Brewing Company
- Mountain States Beet Growers Association
- Stillwater County Commission
- Stockman Bank – Worden
- Yellowstone County Commission
Friend ($1,000+):

- Farmers Union Oil Company – Worden
- Fidelity Exploration & Production Company
- 1st Bank – Sidney
- Vernon & Averill Keller – Fishtail
- Land O’Lakes Foundation
- Kathy McCleary – Billings
- Montana Farm Bureau Federation
- Tim Nessan Family – Billings
- Don & Leona Steinbeisser – Sidney
- Town & Country Supply Association – Laurel
- Malvern & Anna Westcott – Corvallis
- Yellowstone County Implement – Billings

Donor (contributions up to $999):

- Harold Armstrong - Belgrade
- Ronald & Violet Balzer - Worden
- Terral & Tammy Balzer – Worden
- Bart Bitz Farms Inc. – Big Sandy
- Jerald & Bonita Bergman – Sidney
- Dave Bergum – Winifred
- Michael & Lorrie Bernhardt – Park City
- Alvin & Deanna Bitz – Box Elder
- Darrin Boss & Peggy Lamb – Havre
- David Broberg – Cut Bank
- Taylor & Shannon Brown – Huntley
- Nancy & Arthur Callan - Corvallis
- Gregg & Ruth Carlson - Havre
- Kirsti & Max Cederberg - Turner
- Diamond Bar J Ranch – Dillion
- Paul & LaNora Dixon – Billings
- Alan Dyer – Bozeman
- Forrest & Sherry Ewen – Ballantine
- Gollehon Farming – Brady
- Donald & Jane Gumprecht – Idaho
- Jeff & Linda Jacobsen – Bozeman
- Lance & Patricia Juedeman – Geraldine
- LeRoy Keller – Havre
- Dave & Karen Kelsey – Molt
- Ken & Diane Kephart – Billings
- Kernaghans Service – Great Falls
- Jim & Lynn Krall – Bozeman
- Lakeview Land & Livestock Inc – Molt
- Bud & Joanne Leuthold – Molt
- Monica & David Lindeen – Huntley
- Greg Mathews – Buffalo
- Montana Agricultural Business Association
- Montana Alfalfa Seed Association
- Montana Grain Elevator Association
- Grady Moog – Joplin
- Moon Beam Farms – Hingham
- Frank & Mary Mosdal – Broadview
- Mountain View Co-Op – Great Falls
- Ramon & Patricia Nile – Forsyth
- Northern Ag Service Inc – Malta
- James & Lorraine Peterson – Buffalo
- Dan & Marliss Picard – Brady
- Rebish & Konen – Dillion
- Rocky Mountain Bank – Billings
- Matt & Julie Rognlie – Bozeman
- Dennis & Susan Schaefer – Billings
- Connie & Van Shelhamer – Bozeman
- Steven & Maureen Simonson – Thompson Falls
- Spring Coulee Land & Cattle – Highwood
- Standley Brothers – Cascade
- Jim & Marleen Story – Corvallis
- Surprise Creek Colony – Stanford
- Kenneth & Connie Taylor – Angela
- Scott Thackery – Havre
- Treasure County Commission
- Kent & Maureen Wasson – Whitewater
- Elizabeth Westcott – California
- David & Janet Wichman – Moccasin
- Yellowstone County News - Huntley

In addition to the new office building at SARC, funds from the Million Dollar Match Fund have been or will be used for new construction and improvements to existing facilities at five of the seven MAES Agricultural Research Centers.

2004 Weather Conditions

Weather conditions experienced at SARC during the cropping season from September, 2003 to August, 2004 are summarized in Table 2. This region of the state entered it’s sixth consecutive year of drought, with the year once again being dryer and warmer than normal. Total annual precipitation was 3.7 inches below the expected average, but most of the shortfall in annual precipitation was experienced during the spring growth period from March through June.

Average temperature for the year was 0.5 °F warmer than normal. Month to month variation in temperature from normal values were quite extreme. Much warmer than normal temperatures occurred from October, 2003 to April, 2004, averaging 2.4 °F above normal during this 6 month period. March temperatures were much warmer than normal, which accelerated early crop growth. Warmer than normal conditions continued in April. May experienced significantly cooler temperatures and above average precipitation. Sub-freezing temperatures experienced during a 3-day interval from May 12 through May 14 resulted in significant damage to a wide range of crops including winter wheat, corn and sugar beets (Appendix Table 1). Spring planted small grains experienced much less injury. Unusually cool temperatures and above average precipitation was experienced during the months of July and August, which delayed maturity of most summer annual crops.
The frost-free period at Huntley during the summer of 2004 was from May 25th to September 21st or 118 days in length (Table 2). The 2004 frost-free period was 7 days shorter than normal, but 2 days longer than the frost-free period experienced the previous season. Accumulated heat units (GDD$_{so}$, GDD$_{corn}$) for the summer growth period were significantly below normal.

### Electronic Availability of SARC Information

Home page for the Southern Agricultural Research Center is “http://www.sarc.montana.edu/”. Annual reports from 1999 to the present year are available to the public over the World Wide Web from this site. Simply select the main menu listing for “Annual Reports +” to locate individual reports by the years listed. Data summarizing daily weather observations, daily soil temperatures and heat unit accumulation during the 2004 calendar year are presented in Appendix Tables 1, 2 and 3, respectively.

An electronic weather station was put into operation during 1999, and continues to provide real time weather information by using radio telemetry to broadcast data to a receiving computer. This information is accessible by the public over the Internet at: “http://www.sarc.montana.edu/wx/”

Additional weather-related information can be accessed from the research center’s home page by selecting the main menu listing for “Weather Information +” and scrolling through the displayed options.

### Acknowledgements

Special recognition goes to the following individuals who provided their time, land and additional resources in support of SARC’s off-station research programs:

- Mr. Gary Broyles, Farmer Cooperator, Rapelje
- Mr. Don Holland, Farmer Cooperator, Forsyth
- Mr. Mike Greytak, Farmer Cooperator, Hardin
- Mr. Dave Kelsey, Farmer Cooperator, Molt
- Mr. Greg Lackman, Farmer Cooperator, Hysham
- Mr. Bill Linger, Farmer Cooperator, Molt
- Mr. Carter Miklovich, Farmer Cooperator, Lodge Grass
- Mr. Ervin Schlemmer, Farmer Cooperator, Fromberg
- Mr. Tony Zinne, Farmer Cooperator, Ryegate

The excellent cooperation and support provided by these individuals has been invaluable to projects conducted by SARC personnel. Special recognition also goes to the individuals who serve on the Southern Agricultural Research Center Advisory Committee (Table 3).

The authors would like to extend their appreciation to the following individuals, most of whom are area students, for their hard work towards the planting, weeding, harvesting and processing many of the research trials in this report; Terra Balzer, Garrison Bellew, Ed Dvorak, Josh Garrett, Brad Hoffman, Jason Kephart, Alex Palmer, Debra Pulasky, Arly Swanson, John Thompson and Mat Walter.

### Disclaimer

Results of research trials reported are considered preliminary, and may not be duplicated or reprinted without permission of the authors or project leaders involved. Montana State University and the Montana Agricultural Experiment Station are equal opportunity, affirmative action institutions. The information contained in this report is supplied with the understanding that no discrimination is intended and no endorsement by the Montana Agricultural Experiment Station or by Montana State University is implied. Use of commercial trade names, commercial services and/or registered trademarks in these reports are for convenience only, and do not imply endorsement or exclusion of these or similar items by Montana State University or the Montana Agricultural Experiment Station.
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<th></th>
<th>2003</th>
<th>2004</th>
<th>Year</th>
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<td></td>
<td>Sep</td>
<td>Oct</td>
<td>Nov</td>
</tr>
<tr>
<td>Precipitation (inches)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Year (2003-2004)</td>
<td>0.20</td>
<td>1.49</td>
<td>0.37</td>
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<tr>
<td>Average (1911-2003)</td>
<td>1.29</td>
<td>1.02</td>
<td>0.63</td>
</tr>
<tr>
<td>Difference</td>
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<td>+0.47</td>
<td>-0.26</td>
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<tr>
<td>Mean Temperature (ºF)</td>
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<tr>
<td>Current Year (2003-2004)</td>
<td>57.4</td>
<td>51.8</td>
<td>27.9</td>
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<tr>
<td>Average (1911-2003)</td>
<td>58.2</td>
<td>47.3</td>
<td>33.7</td>
</tr>
<tr>
<td>Difference</td>
<td>-0.8</td>
<td>+4.5</td>
<td>-5.8</td>
</tr>
</tbody>
</table>

**Last Killing Frost in Spring**¹/

- 2004: May 25 (27 ºF)
- Average (1911-2003): May 16

**First Killing Frost in the Fall**¹/

- 2004: September 21 (28 ºF)
- Average (1911-2003): September 19

**Frost-free period**

- 2004: 118 days
- Average (1911-2003): 125 days

**Growing Degree Days (Base 50)**²/

- 2004: 1,669 GDD (ºF)
- Average (1911-2003): 1,871 GDD (ºF)

**Growing Degree Days (Base Corn)**²/

- 2004: 1,806 GDD (ºF)
- Average (1911-2003): 1,947 GDD (ºF)

**Maximum Summer Temperature**

- 102 ºF on July 19, 2004

**Minimum Winter Temperature**

- -32 ºF on January 5, 2004

¹/ In this summary, 32 ºF is considered a killing frost. Average last and first killing frost dates are calculated on a 50% probability of a minimum temperature occurring below a threshold temperature of 32.5 ºF based on observations from 1911 to 2003.

²/ Growing degree days calculated from temperatures observed during the frost free period from May 25 through September 21 for 2004, and for the same 118 day interval from the period of record of 1911 to 2003.
Table 3. Southern Agricultural Research Center Advisory Committee Membership, January 1, 2005.

<table>
<thead>
<tr>
<th>Member</th>
<th>County</th>
<th>First Appointed</th>
<th>Current Term</th>
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<td><strong>Farmer/Ag. Industry Members</strong></td>
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<tr>
<td>Mike Greytak</td>
<td>Big Horn</td>
<td>1998</td>
<td>2007</td>
</tr>
<tr>
<td>Rodney Jabs</td>
<td>Big Horn</td>
<td>1998</td>
<td>2007</td>
</tr>
<tr>
<td>(vacant)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dennis Newton</td>
<td>Carbon</td>
<td>1996</td>
<td>2008</td>
</tr>
<tr>
<td>Ervin Schlemmer</td>
<td>Carbon</td>
<td>2002</td>
<td>2008</td>
</tr>
<tr>
<td>Bill Griffin</td>
<td>Custer</td>
<td>2001</td>
<td>2007</td>
</tr>
<tr>
<td>Mark Helland</td>
<td>Custer</td>
<td>2001</td>
<td>2007</td>
</tr>
<tr>
<td>(vacant)</td>
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<td></td>
<td></td>
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<tr>
<td>Greg Lackman</td>
<td>Rosebud/Treasure</td>
<td>1996</td>
<td>2008</td>
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<td>(vacant)</td>
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<td>Mike Bernhardt</td>
<td>Stillwater</td>
<td>1996</td>
<td>2008</td>
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<tr>
<td>David Kelsey (Chair)</td>
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<td>1996</td>
<td>2008</td>
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<tr>
<td>Terral Balzer (Vice Chair)</td>
<td>Yellowstone</td>
<td>1995</td>
<td>2007</td>
</tr>
<tr>
<td>Warren Frank</td>
<td>Yellowstone</td>
<td>2003</td>
<td>2006</td>
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**Montana Cooperative Extension County Agent (Ex Officio) Members**

<table>
<thead>
<tr>
<th>Member</th>
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<tbody>
<tr>
<td>Wendy Dean</td>
<td>Big Horn</td>
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<tr>
<td>(vacant)</td>
<td>Carbon</td>
</tr>
<tr>
<td>Kent Williams</td>
<td>Custer</td>
</tr>
<tr>
<td>John Pfister</td>
<td>Musselshell/Golden Valley</td>
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<tr>
<td>Janna Kincheloe</td>
<td>Rosebud/Treasure</td>
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<tr>
<td>Lee Schmelzer</td>
<td>Stillwater</td>
</tr>
<tr>
<td>Paul Dixon</td>
<td>Yellowstone</td>
</tr>
</tbody>
</table>

1/ Term limits are 3 years. Advisory committee members may serve no more than 3 consecutive terms.
2/ Serves as the SARC delegate on the MAES/College of Agriculture State Advisory Committee.
3/ Serves as a SARC alternate on the MAES/College of Agriculture State Advisory Committee.