The Sugarbeet is published by The Amalgamated Sugar Company. The magazine is prepared by the Agriculture Department to provide growers with up-to-date information on growing and harvesting sugarbeets. The magazine is also published to help upgrade the standards of the U.S. beet industry by providing a reliable source of information for agronomists, scientists, sugar company personnel, students, and others interested in this vital food crop.

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ABOUT THE COVER

Rocky and Terrie Trail had this picture taken at Thanksgiving, 2014 with their grandchildren on one of the many John Deere tractors Rocky’s Dad, Lee Trail, had restored. They are standing in front of the barn Lee and Alice (Rocky’s Mother) built in the mid 1940’s. The original farm is now being farmed by Rusty Trail, representing the third generation of Trails. Lee and Alice started with only 40 acres. The Trails now farm 2000 acres. In the picture from left to right are Rocky Trail, Addison Trail, Isabella, Sofia, and Kyler Strickler, and Terrie Trail, Rocky’s Wife.
PRESIDENT’S MESSAGE

TAking INVENTORY AND MAKING IMPROVEMENTS

JOHN MCCREEDY, PRESIDENT AND CEO, AMALGAMATED SUGAR

To remain highly competitive in the national sugar industry, the Cooperative is aggressively pursuing three core Strategic Initiatives: (i) increase tare lab sugar content to 18%; (ii) decrease farm-to-factory economic losses by 30%; and (iii) further implement our national sales strategy. Last June, the Board of Directors and Management began a process of self-examination, asking “How can we restructure to improve our competitive position and achieve our Strategic Initiatives?”

The result of this process was a specific action plan. I am pleased to report that many elements of the plan have been implemented:

• The leadership team has been strengthened.
• The Cooperative’s seed selection and approval process has improved.
• Communication between Factory Districts, Agricultural Districts, Management and Members has improved.
• The Agricultural Research Department has been “repurposed” and improved.
• Additional improvements to the factories have been made.
• Internal financial controls have been strengthened.
• A simplified Company logo was adopted and a new website was launched as part of strengthening and improving our information management system.

While we were “taking our own inventory”, the sugar industry as a whole was working extremely hard. Sugar from Mexico is now regulated, the market has stabilized, all natural sugar is regaining its stature as the sweetener of choice, and promising signs of growth are beginning to emerge. There is no better time than now to complete the evaluation of our strengths and weaknesses, and implement the required actions necessary to achieve each of our Strategic Initiatives.

We have much work left to do. If we stay focused, support each other, and remember at all times that we are a Cooperative -- an association of sugarbeet growers who voluntarily cooperate for their mutual economic, social and cultural benefit -- we will be successful.

Thank you to all of our Members and employees for their diligent and sustained effort.

VICE PRESIDENT’S MESSAGE

FORWARD TOGETHER

PAT LAUBACHER, VICE PRESIDENT OF AGRICULTURE

We have set goals of attaining 18% grower sugar and reducing farm-to-factory losses by 30%, both by 2020. As we move to refocus our improvement efforts, growers will be challenged to change how they grow and harvest sugarbeets. If growers are going to increase sugarbeet quality, it will require improved seed varieties as well as new and different agronomic practices.

Change is never easy and can be uncomfortable, but continuous improvement requires change. We have begun the internal change process by repurposing the former “Ag Services Department” into what is now known as Sugarbeet Quality Improvement (SBQI), led by Greg Dean. Greg and his team have been challenged to lead and carry out the change effort. The SBQI team and our Agriculture staff need input from you the growers about how we can improve the type and quality of our research efforts.

The launch of our new website, amalgamatesugar.com is well underway. By early 2016, growers will have new, unique access to their agronomic records. We want growers to be able to quickly and easily pull data from the website, so that you can compare your production to that of your district and to the entire company. Good, accurate and complete data will help provide a collective lift to all growers and put us on track to reaching our goals.
After 41 plus years of service to The Amalgamated Sugar Company LLC, Vic Jaro retired May 1, 2015.

Vic began his career with Amalgamated Sugar in 1973 when he was hired as a Mechanical Engineer at the Twin Falls, Idaho Facility. He was promoted in 1979 to Combustion Engineer (Twin Falls), promoted in 1980 to Plant Engineer (Twin Falls), promoted in 1987 to Factory Superintendent (Twin Falls), and in 1996 was promoted to the position of Plant Manager overseeing the Twin Falls Facility, a position he held until 2000.

In 1997, with the formation of Snake River Sugar Company, Amalgamated Sugar became a grower-owned Cooperative and Vic continued with his career by receiving a promotion in 2000 to the position of Assistant to the President allowing him the opportunity to join the “Corporate Office” which at the time was based in Ogden, Utah. He held this position until 2002 when he was promoted to the office of Vice President, Agriculture. During his service as Vice President, Agriculture Amalgamated Sugar transitioned the Corporate Office to Boise, Idaho in 2003. Vic continued serving in this position until 2006 when he was promoted to President and Chief Executive Officer, a position he held until his retirement date.

Vic’s career accomplishments include:
- Vic oversaw the installation of the first molasses separator at the Twin Falls factory in the 1990’s that allows an additional 10 – 13% sugar recovery.
- Vic modernized beet pile management techniques that save the Cooperative millions of dollars in sugar losses each year.
- Vic was instrumental in the industry’s adoption of Roundup Ready technology.
- Vic led the development and completion of a 5-Year Improvement Plan that entailed:
  - $120 million in modernization and capital improvements at Amalgamated Sugar’s facilities.
  - Establishing a strategic partnership with Sucden America’s Corporation with the creation of National Sugar Marketing LLC.
  - Encouraging improved agriculture practices by using “Vic’s Challenge Fields” to demonstrate the value of utilizing best agriculture practices.
- Vic tirelessly pursued 129,000 lb. truck weight limits on Federal and State Highways.

Vic is a graduate of the United States Merchant Marine Academy at Kings Point, New York, and served as an officer (Lieutenant) in the U.S. Merchant Marine and Naval Reserve. He graduated with a Bachelor of Science, Marine Engineering in 1969 and prior to joining the Merchant Marines, he graduated from Center Moriches High School (1965) in the top ten percent of his class.

Vic lives in Buhl with his wife Janine; they have three grown children and three grandchildren. He enjoys flying Idaho’s back country, kayaking, hunting, fishing, and helping Janine with her horses.

Vic leaves behind a legacy of hard work, and an undying dedication to the domestic sugar beet industry and the owners and employees of Amalgamated Sugar.
John Schorr’s distinguished career was spent helping growers and agricultural companies succeed in their business. Discovering “why and how” agricultural businesses can succeed has always been an important goal in John’s 25 year career with Amalgamated Sugar.

As a fieldman for Amalgamated Sugar John worked to understand poor stand counts. While working in the Nampa district he noticed that many field stands were uneven. By taking stand counts of each row in the field it was shown that the planter boxes were not evenly adjusted. In some cases there was a 60% variation between rows. These results showed the importance of offering the growers a service to adjust their planters and John developed a five year plan to do so in his district. Due to this plan many growers were able to increase the uniformity of their stands.

When the cooperative was organized there was a debate between members of the Board of Directors as to how freight participation was to be addressed. Management asked John to study the problem and suggest how to address this issue equitably. John developed a system that charged each grower a freight participation rate using a “cents per ton mile” basis from the grower’s delivery station to the nearest factory. Freight increases were to be shared 50/50. The company assumed 50% of the increase and the growers assumed the other 50%. Through balancing the new rate to the old rate, a system was developed to make the change in rates over a ten year period. The system was fully implemented in 2008 with freight costs distributed more equitably.

As growers yields have increased and the equipment to harvest has improved, new pile grounds and pilers have been needed. Since 1992 John has been involved in managing the companies pile grounds and obtaining funds to build new facilities. John was also involved in the development and use of field loaders. This allows beets to be taken directly to the factory, helping reduce the amount of beets kept at the pile grounds. John’s ingenuity helped reduce the capacity problems that were being experienced at the pile stations.

Another example of how John helped the company increase their efficiency was the work he did with Jim Adams. In 2000 John worked with Jim Adams, owner of a long arm track hoe, to discover a way to strip piles that would do minimal damage to the beets. John recommended to management that the project be used in the Mini-Cassia district. It was approved resulting in major savings to the sugar company and increased profits to the growers.

An important part of any agriculture program is that of research. When John was promoted to Corporate Director of Agriculture he selected Dennis Searle to be manager of agriculture services. Dennis and John organized a research program that helped increase the profitability of the company. The harvest studies that came from this research resulted in helping Amalgamated Sugar understand how to maximize yields. This group also developed a research harvester, the best in the nation to date.

While working as the Director of Agriculture, John developed a career advancement program. This program established a career path that allows employees to achieve recognition for excellent work ethics, increase in salary through increased skills, and advancement in their careers. With the help of the agriculture managers a set of criteria was established that has been the means of measuring advancement for agriculture consultants. Through the efforts of this program Amalgamated Sugar has been able to retain their top talent and help promote from within the company.

John Schorr’s career has been an example of using “why and how” research to develop better efficiencies in production and employee development. Throughout his career John has found creative and efficient ways to address the challenges of a growing company. The solutions that John and his coworkers have developed are changing the way things are done in the sugar industry and his work will continue to influence the sugar industry for years to come.

TRIBUTE TO JOHN SCHORR
BY CHER AND SCOTT ALLEN, DAUGHTER AND SON-IN-LAW OF JOHN

HARVEST ISSUE 2015
SUCCESS!
It is official, for the first time in the digital world—The Amalgamated Sugar Company, LLC. has a WEB site! For now, the site is clean, simple and very basic. This certainly doesn’t mean that we are done—as they said in the 70’s—"We’ve Only Just Begun". There are many people across the company busy assembling more current and interesting content that will be published soon. For now, please visit the new site at either www.amalgamatedsugar.com or www.amalsugar.com and review the Public-facing information there.

The next phase of the project is to turn the current ‘sections’ of the page into actual pages (or sets of pages) with additional content and information on them to finish creating our face to the outside public. Quickly on the heels of that effort we will begin the facelift for the Grower section of the site where we will first clean up the organization/navigation, and the look of the existing links and information. Watch for updates throughout the fall and winter as the site continues to grow and develop!

Sincerely,
Amalgamated Sugar IT Team

DENNIS SEARLE RETIRES AFTER 42 YEARS OF SERVICE

In March 1973 Dennis Searle came to work for The Amalgamated Sugar Company as a fieldman working in the Elwyhee District. Two years later he transferred to the Nampa Factory District there he continued to serve growers until he was promoted to the position of Agronomist in 1989. As the agronomist, Dennis assumed the responsibilities of the tare lab in Nyssa, Oregon until its closing when he took over the beet quality lab in Paul, Idaho. In 2007, Dennis was promoted to Manager of Agricultural Services, a position he held until he retired on March 31, 2015.

Dennis graduated from Boise State University with a Bachelor of Science in Biology. He later went on to earn a Masters of Arts degree in Guidance and Counselling from the College of Idaho.

Dennis lives in Nampa with his wife Cheryl, together they have six children and 14 grandchildren. During his career Dennis and his wife developed a love of travel. In retirement they have monthly trips planned to various parts of the United States. Dennis also enjoys spending time pursuing his other passions that of reading, continued involvement in church service and keeping up with family activities.

During Dennis’s career at The Amalgamated Sugar Company, he was involved in and accomplished many things, including:
• Editor of the grower magazine “The Sugarbeet”.
• Developing a company sugarbeet research department.
• Working with Dr. Saad Hafez to get growers to use trap crop/green manure’s in their rotations
• Working with grower’s to improve their irrigation practices
• Sharing with grower’s his knowledge of best management practices to deal with Sugar Beet Root Maggot
• Creating a better morale and spirit of team work at the Beet Quality Lab which led to improved retention and output.

We wish Dennis and Sheryl Searle a happy and healthy retirement.
SUCCESS!

It is official, for the first time in the digital world – The Amalgamated Sugar Company, LLC. has a WEB site! For now, the site is clean, simple and very basic.

This certainly doesn’t mean that we are done – as they said in the 70’s – “We’ve Only Just Begun”. There are many people across the company busy assembling more current and interesting content that will be published soon. For now, please visit the new site at either www.amalgamatedsugar.com or www.amalsugar.com and review the Public-facing information there.

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Watch for updates throughout the fall and winter as the site continues to grow and develop!

Sincerely,

Amalgamated Sugar IT Team
SAMPLING POLICY TO DETERMINE SUGARBEET DELIVERY CUTOFF DUE TO WARM SUGARBEET TEMPERATURE (AS OF SEPT 9, 2015)

BY CLARK MILLARD, AGRICULTURAL MANAGER, NAMPA

The purpose the Policy is to fairly determine and enforce paragraph 5(d) of the Grower Agreement: “All sugarbeets delivered by Grower shall be free from frost damage, and shall have a pulp temperature no greater than 55 degrees Fahrenheit at the time of delivery to Growers assigned receiving station.” The purpose of paragraph 5(d) is to ensure that sugarbeets going into long term storage piles are in a condition that will minimize respiration and spoilage, resulting in the least amount of sugar loss in the pile that can be expected. This Policy applies to warm beet procedures only, and does not apply to beets that display visual evidence of frost damage. The Policy for stopping delivery of high temperature sugarbeets will be as set forth below:

When a load of beets is sampled, the first beet randomly selected should be the one that the temperature sample is taken on. Sampler should not search throughout the load for a beet that may be either higher or lower in temperature. The correct sugarbeet sampling method will be to insert the thermometer into the beet approximately two inches down from the top of the beet, and two inches deep into the beet as shown:

1) All temperatures referenced in this Policy are measured in Fahrenheit.

2) Grower receives a text message when his delivered beet temperature reaches 50 to 52.9 degrees. This alerts him that temperatures are warming. Text reads: “Warm beet temperature, please make adjustments.”

3) Grower receives a text message when his delivered beet temperature reaches 53 to 54.9 degrees. If he previously received a message telling him his temperatures were between 50 and 52.9 degrees, this message informs him that temperatures are continuing to rise, and gives him some idea of how long it took for the temperature to rise 3 degrees. Text reads: “Beet temperature approaching 55 degree threshold.”

4) When the first beet is probed in a load that is at 55 degrees or higher, that temperature is noted on the tare house tablet, and the notification system sends a message to the Crop Consultant and the Grower. The text reads: “1st 55 degree load received.”

   a. At this time, sampling for temperature purposes only is conducted on every load of beets that grower delivers, and the temperatures noted in the tare house tablet.

   b. If the Grower delivers loads of beets with temperatures at or above 55 degrees three times in a row, his harvest is stopped. If, during this time, a temperature is taken that is lower than 55 degrees, the count starts over, and the Grower is allowed to continue harvest until he has three consecutive loads with temperatures at or above 55 degrees.

   c. Upon the second successive 55 degree or greater load received, a text will be sent to the Crop Consultant. The text reads: “2nd 55 degree load received.”

   d. When the Grower reaches three consecutive loads of beets at or above 55 degrees, Grower and Crop Consultant each receive a text, and the Grower will receive a call from the Crop Consultant. The text reads: “High beet temperatures contact your Consultant.” At this time, Grower’s harvest operations should stop.

5) Grower is allowed to unload any trucks that are already under load, including the one he is currently loading, but should then stop all harvest immediately.

6) Grower should not continue to load trucks during the warm time of the afternoon that will stay loaded all night, and be delivered first thing in the morning. These beets will be too warm.

7) All thermometers used in care houses company-wide will be calibrated at the beginning of each day in an ice water bath. This calibration will be done by a trained person, following the instructions provided by the manufacturer of the thermometer.
COLLECTING GAR, AN IT PERSPECTIVE

DARIN WELLS, IT INFRASTRUCTURE MANAGER

During the past few years, mobile computing has crept into our lives. For some, it came with a lot of fanfare and excitement—like a treasure hunt under the Christmas tree for the ringing package. For others, it was a simple business decision related to faster communication, or perhaps it came as a requirement enabling another need such as sharing pictures with distant relatives.

For most of us, it began slowly, with just an email here or there, or a text from Rex stating the new pump had hit a bump, or lunch on a box while learning of a new pitcher for the sox. Regardless of how mobile computing started for you, nearly everyone has become reliant on having instant access to information.

Not only is access to information important, it is also most efficient and accurate if it can be gathered remotely. One of the newest areas in the company that will soon use remote data collection is the Grower Agronomic Record, or GAR. Having the opportunity to enter information about the field, in the field, will help us all provide more accurate and timely information about our crops and production practices.

To help us mobilize the GAR as quickly as possible, we’ve decided to leverage a vendor-partner called fieldsync™ from Meridian, Idaho. Their flagship product is well suited to fulfill our needs and their application was well engineered to provide a dynamic environment—something our end goal demands.

In the Information Technology realm there are some tried and true principles that we want all of our solutions to adhere to. These are often referred to as the “ilities”. These “ilities” may change slightly depending on who you ask, and their rank in importance may vary. The following seven “ilities” demonstrate our intent, specifically for the GAR program: Usability, Maintainability, Scalability, Reliability, Security, Extensibility, and Portability. While the first five “ilities” may be fairly self-explanatory, let me elaborate on the last two.

An Extensible solution is one that will grow with us and is flexible enough to change as we change. This ability to adapt to change can be clearly seen in the fieldsync™ solution. They use a configuration file to generate the list of questions a user will enter during the workflow. It is relatively simple to change the content of the file to alter and improve the questions as necessary. The fieldsync™ solution also allows for many different types of user input or “answers” to the questions. This can be anything from a drop down list of predetermined answers to taking a picture with the built in camera or scanning a barcode.

Portable solutions embody sound design by ensuring each part of the system is well defined and offers a clear separation of duties. Portable solutions also utilize standards-based components. They are generic in their implementation, remaining flexible to work with many different support technologies. Examples of fieldsync™ portability include being able to utilize a variety of database technologies, running on iPads, Android tablets and various web browsers. They use standard networking so the devices can run over wired, wireless or cellular data networks.

The fieldsync™ system also offers a high degree of usability by ensuring it can continue to work in an offline mode. As odd as it may seem to us, the cell phone companies just don’t see much revenue opportunity in the middle of a sugarbeet field. By allowing the application to continue to gather data when the server is unavailable, storing the data to be synchronized with the server when it is available and maintaining the list of user questions locally, the fieldsync™ application is able to run wherever and whenever it is needed, insuring a reliable user experience.

As your information team we strive to provide high quality solutions to you using best practices such as the “ilities”. Because the GAR questionnaire is relatively small, yet well-defined, it is an excellent candidate to fully evaluate and test.
the fieldsync™ product. Not only does this allow for rapid prototype and deploy of a mobile solution, we also have the opportunity to learn and determine how we can leverage the product for future information collection tasks.

By now it is pretty clear mobile computing is a very important part of our future. Not only for obvious activities such as viewing a picture of a new insect on your smart phone, but also being able to enter accurate data for future analysis. The only things more exciting than the challenges we face are the technologies we will deploy to solve those challenges. What does the future hold? Will it be a 3D laser mapping system to understand and improve water runoff, or a drone with image recognition for early detection of crop issues, or perhaps a Nano army of sugarbeet diggers? Regardless of the technology, there's a high chance that much of it will be mobile and in our fields.

Present-day farm operations are becoming more and more business oriented. The key to becoming a successful sugarbeet producer is being a good manager of finances, agronomy, seed varieties, irrigation, and other products used to enhance production.

Another key aspect to success in producing any crop is keeping accurate records by establishing a system that is simple and accessible. Records need to be complete and accurate in order to allow informed decisions that will help maintain and improve a farm’s profitability. With these important details in mind, let us take a look at the GAR database and why it can be a beneficial tool to a sugar producer.

One commonly asked question by sugarbeet growers is, “Which variety performs best?” During the time of regulated sugar beet production, growers were required to provide the following information to APHIS:

- Planting dates
- Re-Plant dates and reason for replanting
- Varieties
- Field size

Using only this information, crop consultants were able to generate performance data for varieties grown at different receiving stations. Growers were able to see first-hand how varieties compared to one another (Figure 1).

Emphasis was laid on the included categories, but other categories (ex. growing days) could be charted as well depending on growers’ interests.

Another question frequently asked by growers is, “When should I plant my sugar beets?” Based data stored in the GAR database, it is easy to determine which week is more ideal for planting. Often, growers are also interested in the percentages that represented re-plants in a particular area. Figure 2 shows yield information ranging from 2011 to 2013 for Minidoka County. Sugarbeets planted from March 15th to April 7th represented a total acreage of 8,436. Sugarbeets planted during this period also represented the highest incidence of replants (63 to 66%). When considering different planting weeks, it is important to pay attention to ERS/acre, tons/acre and percent sucrose also.

![Figure 2](image-url)

Figure 3 is a similar chart based on the 2014 planting date information. In 2014, eight fields were planted before April 1st and 88% of those acres were replanted. The majority of the acres (8,985 A) were planted between April 8th and April 22nd with only 2 to 5 % replants. Again, it is important to consider ERS/acre, tons/acre and percent sucrose when deciding on a planting date. When data is presented in this manner, it allows for easy access to the pertinent information without having to sift through extra data.

In addition to varietal performance data based on planting date, information related to previous crops could provide valuable help to answer certain challenges. For example, a consultant could ask questions like, “Are there varieties that perform better following a potato or a barley crop?” or, “Does the previous crop play a significant role in the outcome of ERS/acre by stimulating the production of more sugar when following a certain crop?”

The charts in this article were made possible because of the information volunteered by growers of the co-op. Without the
Figure three is a chart made from information that was gathered specifically for variety. This chart is for stations Adelaide and Meridian and shows the following:

- Number of fields
- Sum of acres
- Tons/acre
- Sugar content
- Nitrates
- ERS/acre
- Beets/100ft.

The emphasis here is to show how much information and types of reporting can be done once we get information from you. From this chart we can begin to see how a variety performs at a receiving station.

Previous crop information is very valuable. Imagine if we could confidently recommend a variety based off of crop history. Perhaps there are two varieties that really shine following a potato crop. Does that mean those same two would perform the same following a barley crop? Or maybe there is a variety that produces more sugar instead of tonnage which we already can identify, but maybe the previous crop plays a significant role in the outcome of ERS/acre. We don’t really know. However, with your cooperation in providing a crop history, the day will come when we can assuredly endorse a particular variety based on what we know from previous crop information.

GAR is getting a major face lift as well as is the entire web page for the company. The company has put together a committee with hopes of getting input from people who will be using cooperation of each grower in giving accurate dates, varieties and other pertinent information, these and other data charts would not be reliable. In addition, the data gathered, although specific to each grower’s operation, is kept anonymous throughout the reporting process. Secrets that make a grower unique in his/her farming operations are not revealed as the data is synthesized. The purpose of the GAR database is to better each individual grower’s farm, the growing area as a whole, and ultimately, the entire Snake River Co-op as it gives each grower the opportunity, based on the data collected, to make educated decisions concerning their own farming practices.

The vision for the co-op’s GAR database is to make it as simple and helpful to the growers as possible. As part of this effort, in addition to the co-op website being updated, the GAR section is getting a major face lift as well. Johnathan Shurtliff, a member of the committee charged with overseeing the GAR section of the website stated, “We already have a ton of information, and as crop consultants, we can hash out reports. But the goal of the new database on the web is to enable a grower to search the data collected from his growing area, make comparisons to those stations, and ultimately make sound decisions from those queries.” The examples shown in this article are but a small vision of what is possible when GAR is fully implemented. By giving GAR a chance to be successful through everyone’s participation, the information gathered will be a powerful decision making tool for all to benefit from.
EFFECTS OF FERTILIZER RATE, IRRIGATION AND CROP RESIDUE ON DISEASES, INSECTS AND WEED CONTROL IN SUGARBEETS

DON W. MORISHITA, W. HOWARD NEIBLING, ERIK J. WENNINGER, AND KELLI M. BELMONT

PROFESSOR OF WEED SCIENCE, ASSOCIATE PROFESSOR OF AGRICULTURAL ENGINEERING, ASSISTANT PROFESSOR OF ENTOMOLOGY, AND GRADUATE RESEARCH ASSISTANT, RESPECTIVELY

In 2014, we reported on the first year results of this study. This report represents the second and final year of this study that was initiated in 2013. The premise of this study came about because little is known about interactive effects of nitrogen fertilizer application rate, irrigation amount, and crop residue (tillage) level on sugarbeet yield and quality, and on the incidence and management of insects, diseases and weeds in sugarbeets.

The primary objectives of the study were to examine the effects of nitrogen fertilizer application rate, irrigation amounts, and tillage level on: 1) moisture content and temperature within the soil profile; 2) emergence and stand establishment of sugarbeet crop; 3) abundance of insect pests and severity of associated crop damage; 4) abundance and richness of natural enemy arthropod fauna; 5) onset, development, and severity of Rhizomania; 6) weed emergence, control, and interference with the crop; and 7) root yield, sugar content, and estimated recoverable sucrose.

At the time of this report, we are still analyzing some of the immense volume of data. This was a very large study with a considerable amount of data collected in terms of soil moisture content, soil temperature, plant stand counts, weed density counts, insect population counts, and sugarbeet yield and quality. However, we will report on the information we have analyzed thus far. Three tillage levels were established to achieve the desired crop residue levels: conventional tillage (CT), strip tillage (ST), and no tillage or direct seeding (DS). The CT and ST treatments were tilled in early November 2012 and 2013. Individual tillage plots were 264 ft wide (144 rows) by 30 ft long. Three irrigation levels were established after seedling establishment. The irrigation rates were based on sugarbeet evapotranspiration (ET) and were 50, 100 and 150% of ET. Each irrigation treatment was applied across all three tillage treatments in each rep. An individual irrigation treatment was 88 ft wide (48 rows) by 90 ft long. In this study tillage treatments and irrigation treatments are main effects. Four nitrogen (N) fertility rates based on The Amalgamated Sugar Company’s recommended nitrogen rate for conventionally tilled sugarbeets. In addition to the recommended rate, which is 1x, three other rates were applied: 0.5x, 0.75x, and 1.25x within each irrigation and tillage treatment. Each fertilizer rate sub-plot was 22 ft (12 rows) by 30 ft long.

Sugarbeet stand counts were taken five times beginning shortly after the first beets emerged on May 16 and ended June 19. One every counting date, stand was equal between the CT and ST and in most cases significantly higher than DS. Sugarbeet stand in the DS was not as good as it was in 2013. On May 29, 2013, which was roughly the peak of emergence for that year, crop stand averaged 180, 185 and 160 plants per 100 feet of row in the CT, ST and DS treatments, respectively.

Insects. Among the pestiferous insects found in the plots, leafminers, black bean aphids and sugarbeet root aphids were abundant enough to sample and make meaningful comparisons among treatments. What we have seen thus far in the 2014 data, there were no differences in leafminer eggs between the tillage, irrigation or nitrogen rate treatments. There were more leafminers in the CT compared to ST and DS averaged across all irrigation and nitrogen rate treatments. There were more leafminers in the CT compared to ST and DS averaged across all irrigation and nitrogen rate treatments. This is similar to what was observed in 2013. On May 31, more eggs per plant were found in the CT plots relative to the ST and DS plots, which did not differ from each other; however, no differences in leafminer eggs were observed among tillage treatments on June 12. On both dates (May 31 and June 12), more leafminer larvae were observed in CT plots than in ST and DS plots, which did not differ from each other.

No black bean aphids were counted in 2013, but in 2014 there was an interaction response of black bean aphids to tillage and fertilizer rate averaged across irrigation treatments. More black bean aphids were found in the CT with 0.5x, 0.75x and 1.25x nitrogen rates than the CT 1.0x nitrogen rate, which had the lowest population of all treatments. There were no differ-
ences in black bean populations in the ST or DS tillage with any of the nitrogen rates applied.

Sugarbeet root aphids in 2013 and 2014 were sampled across all 50% ET plots by digging eight beets per plot and assessing infestations using an established rating scale. Since root aphid cannot tolerate high amounts of water, it was assumed that the lowest irrigation level would have the greatest amount of root aphid colonies. Root aphid ratings did not differ in regard to either tillage or fertility treatment.

Plant disease. As was observed in 2013, random Aphanomyces and Rhizoctonia diseased plants were found throughout the study site in 2014, but there was no correlation with tillage, irrigation or nitrogen fertilizer rates.

Weed seedling emergence. Weed seedling emergence counts were taken four times in 2013 on June 3, June 19, July 3 and July 17 within two fixed 2.7 ft² (0.25 m²) areas between the rows and within the row in each plot. Weed counts were taken before each of the two times the sugarbeets were sprayed for weed control and two more times at two week intervals after the last application of glyphosate + Outlook at 22 and 18 fl oz/A. In both years, there were some differences in total weed populations between tillage and fertilizer treatments between and within the row during the counting periods. In 2013, there were more total weeds between rows in the CT than the ST or DS at each of the counting dates, except the first one on June 3. In 2014, this was also the same case on two of the four counting dates. Total weed densities within the row were only higher in the CT than the DS on two counting dates over both years. On all other counting dates, over both years, there was no difference. On several counting dates, total weed densities were lowest with the 1.25x N rate, but did not show any other consistent responses with the lower rates. The similar results observed in 2013 and 2014 lead us to believe there is little difference in total weed emergence between tillage systems, except that more weeds tend to be found between rows in CT compared to ST and DS, where the soil is not disturbed.

Yield response. In 2013, there was a significant (P=0.05) tillage by irrigation rate interaction for root yield and a tillage by irrigation rate interaction for sucrose yield at the P=0.10 significance level (Table 1). Interestingly, root yield and sucrose yield was equal between DS and the CT or ST treatments at 100% ET. However, at 150% ET, the DS yield was significantly lower than CT or ST and statistically equal to CT or ST at the 50% ET rate. In 2014, there was no statistical difference in root or sucrose yield between any of the tillage treatments regardless of the irrigation treatment or N rate. When the data from both years are combined, there is a significant difference in root yield between years and between tillage treatments (Table 2). There also is a difference in sucrose yield between years, irrigation treatment, and N fertilizer rate (Table 3). There was no difference in sucrose yield between tillage treatments.

A more complete analysis of the data collected over the two years of this study will provide additional insight of the agronomic and economic differences in the response of sugarbeets grown in three different tillage systems, as well as the response of disease, insect and weeds in these three tillage systems. Preliminary conclusions indicate that it is economically feasible to grow sugarbeets in a direct seed system as well as in strip tillage.

### Table 1. 2013 sugarbeet root and sucrose yield in response to tillage and irrigation rate.

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Irrigation rate % of ET</th>
<th>Root yield ton/A</th>
<th>Sucrose yield lb/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>50</td>
<td>38 d</td>
<td>8,624 b</td>
</tr>
<tr>
<td>Direct</td>
<td>50</td>
<td>35 ef</td>
<td>8,660 b</td>
</tr>
<tr>
<td>Strip</td>
<td>50</td>
<td>39 sde</td>
<td>9,134 ab</td>
</tr>
<tr>
<td>Conventional</td>
<td>100</td>
<td>43 a</td>
<td>10,611 ab</td>
</tr>
<tr>
<td>Direct</td>
<td>100</td>
<td>39 abcd</td>
<td>9,988 ab</td>
</tr>
<tr>
<td>Strip</td>
<td>100</td>
<td>42 ab</td>
<td>10,252 ab</td>
</tr>
<tr>
<td>Conventional</td>
<td>150</td>
<td>43 a</td>
<td>11,342 a</td>
</tr>
<tr>
<td>Direct</td>
<td>150</td>
<td>34 f</td>
<td>9,106 ab</td>
</tr>
<tr>
<td>Strip</td>
<td>150</td>
<td>42 abc</td>
<td>11,223 a</td>
</tr>
</tbody>
</table>

### Table 2. Sugarbeet root and sucrose yield averaged over 2013 and 2014 in response to tillage.

<table>
<thead>
<tr>
<th>Tillage</th>
<th>Root yield ton/A</th>
<th>Sucrose yield lb/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>43 a</td>
<td>9,733 a</td>
</tr>
<tr>
<td>Direct</td>
<td>39 b</td>
<td>9,428 a</td>
</tr>
<tr>
<td>Strip</td>
<td>42 ab</td>
<td>9,119 a</td>
</tr>
</tbody>
</table>

### Table 3. Sugarbeet root and sucrose yield averaged over 2013 and 2014 in response to nitrogen rate.

<table>
<thead>
<tr>
<th>Nitrogen rate</th>
<th>Root yield ton/A</th>
<th>Sucrose yield lb/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of recommended</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>41 a</td>
<td>9,421 ab</td>
</tr>
<tr>
<td>75</td>
<td>41 a</td>
<td>9,590 a</td>
</tr>
<tr>
<td>100</td>
<td>40 a</td>
<td>9,076 b</td>
</tr>
<tr>
<td>125</td>
<td>42 a</td>
<td>9,621 a</td>
</tr>
</tbody>
</table>

### Table 4. Sugarbeet root and sucrose yield averaged over 2013 and 2014 in response to nitrogen rate.

<table>
<thead>
<tr>
<th>Nitrogen rate</th>
<th>Root yield ton/A</th>
<th>Sucrose yield lb/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of recommended</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>41 a</td>
<td>9,421 ab</td>
</tr>
<tr>
<td>75</td>
<td>41 a</td>
<td>9,590 a</td>
</tr>
<tr>
<td>100</td>
<td>40 a</td>
<td>9,076 b</td>
</tr>
<tr>
<td>125</td>
<td>42 a</td>
<td>9,621 a</td>
</tr>
</tbody>
</table>
Every sugarbeet grower who has read an agriculture trade magazine has seen at least one article about glyphosate resistant weeds in the Midwest. How many are aware that glyphosate resistant kochia has been identified in eastern Oregon and western Idaho? In 2014, glyphosate resistant kochia was confirmed in both states. This year, Joel Felix, Oregon State University Weed Scientist, and University of Idaho Weed Scientists have initiated a survey for glyphosate resistant weeds working with Amalgamated Sugar Company Crop Consultants. As of this writing, no new sites of glyphosate resistant weeds have been documented.

Our hope is that sugarbeet growers in Idaho and Oregon don’t take the same path that many corn, soybean and cotton growers took in the Midwest and South. That path was one of ignoring the problem or hoping that another herbicide will come along and save the day. It’s ironic that with the introduction of Roundup Ready crops in the mid-90s, all of the chemical companies downsized their herbicide discovery groups because they figured there was no way they could compete with the Roundup Ready crop technology. Consequently, their efforts have been focused more on developing new fungicides and insecticides, with little or no effort on discovering and developing new herbicides. In fact, there has not been a new herbicide mode of action discovered in the past 20 years. This means that there are no new herbicides on the horizon. You may here of some new trade names, but they are not new herbicides. To compound our problem, sugarbeets are not a major crop that companies are trying to develop herbicides for. This means that the chances of a new herbicide being registered for use in sugarbeets is pretty slim.

Of course, there is scuttlebutt about stacked gene sugarbeets, like corn and soybeans, that will enable using 2,4-D or dicamba (think Clarity or Banvel) along with glyphosate for weed control in sugarbeets. The important thing to consider is that neither of these herbicides are very effective for controlling kochia. Plus, how long do you expect this combination to last before we have 2,4-D and/or dicamba resistant kochia in our sugarbeet fields? As a matter of fact, dicamba resistant kochia already exists in Idaho and many other states.

One advantage that Idaho and Oregon sugarbeet growers have over growers in the Midwest and South to reduce the
th reat of glyphosate resistant weeds is that we have diverse crop rotation opportunities that help reduce the selection pressure for glyphosate resistant. The Red River Valley in eastern North Dakota and western Minnesota also has diverse crop rotations, but Roundup Ready corn, soybeans and sugarbeets are a part of many rotations, which goes to show that diverse cropping systems is not the only answer. Using glyphosate year after year, especially without another herbicide mode of action poses the greatest chance of selecting for glyphosate resistant weeds even if it is another crop. There are over 300,000 acres in Idaho where field corn is grown and that increases the chance for glyphosate resistant weeds because nearly all of the corn is Roundup Ready and most of it is only sprayed with glyphosate for weed control. If a sugarbeet rotation includes two years of field corn in a three or four year rotation and glyphosate is the only herbicide used on those crops, it is almost a certainty that glyphosate resistant weeds will appear.

Kochia isn’t the only weed to be on the lookout for suspected glyphosate resistance. Common lambsquarters, which has always been a challenge to control with glyphosate is a weed to watch for. Our preliminary studies indicate we may have glyphosate resistant lambsquaters in Idaho, as well. Another weed that poses a potential threat to Idaho growers is Palmer amaranth. This is a cousin to redroot pigweed, but can make redroot pigweed look like the runt of the litter when growing next to Palmer amaranth. So why is Palmer amaranth a potential threat to Idaho growers anyway? In two words the answer is cotton seed. Cotton seed is a popular feed used in dairy cattle rations and Palmer amaranth is a common weed that infests cotton fields, almost everywhere cotton is grown in the US. Palmer amaranth seed are small like redroot pigweed, but can get stuck in the lint of cotton seed and transported to other places. Glyphosate resistant Palmer amaranth has become widespread in cotton fields. If you have any doubts that Palmer amaranth can become established in Idaho, then you need to look at some Michigan fields that had manure spread on them. Glyphosate resistant Palmer amaranth began showing up in Michigan just a few years ago as a new weed species in the state. The seed coat of Palmer amaranth is hard enough to survive passage through a cow’s intestinal system, which means the seeds end up in the manure and eventually spread onto growers’ fields. That’s exactly how it showed up in Michigan fields.

In 2012, the Weed Science Society of America published a series of articles about herbicide resistance management. Included in the articles was a list of best management practices or BMPs for resistance management. The following list includes most of those recommendations with some additional suggestions specific to sugarbeet production.

1. Do not grow a Roundup Ready crop more than once every four years in any given field.

2. In non-Roundup Ready crops, avoid using glyphosate as a broadcast application before the crop emerges or after harvest.

3. Tank mix or use another herbicide with glyphosate when it is used in sugarbeets. For example, Nortron can be applied preplant, preemergence or postemergence in sugarbeets, which means it can be used with or without glyphosate. Other herbicides that can be tank mixed with glyphosate in sugarbeets include Dual Magnum, Eptam, Outlook, Treflan and Betamix. It is important to keep in mind that none of these herbicides, except Betamix, will control any weeds that have already emerged.

4. Apply the labeled glyphosate rate at recommended weed sizes. In Roundup Ready sugarbeets and corn, the minimum application rate when the weeds are less than about 2 to 3 inches is 0.75 pounds acid equivalent per acre. This is equivalent to 22 fluid ounces per acre of Roundup PowerMax. If a different brand or formulation with less active ingredient is used, more product per acre will need to be applied in order to apply 0.75 pounds acid equivalent per acre. Also, due the hardness of our water used to mix with glyphosate, the adding ammonium sulfate will enhance the effectiveness of glyphosate.

5. Scout fields for escapes or new invaders.

6. Do not let any weeds that have survived herbicide application produce seed.

7. Do not rely totally on glyphosate for controlling weeds on field borders, roadsides and ditchbanks. These can also be a source of glyphosate resistant weeds.

There is no guarantee that following these recommendations will keep glyphosate resistant weeds from spreading in eastern Oregon and across southern Idaho. However, it is a certainty that glyphosate resistant weeds will become a problem if these herbicide resistance management strategies are ignored.

Note: Trade names are used to simplify the information; no endorsement is intended.
CERCOSPORA LEAF SPOT ON SUGAR BEET
IMPORTANCE, IDENTIFICATION, AND MANAGEMENT

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SUGAR COMPANY, LLC, BOISE, ID. DRAGANA BUDAKOV, UNIVERSITY OF NOVI SAD, NOVI SAD, SERBIA. ED
BECHINSKI, UNIVERSITY OF IDAHO, MOSCOW, ID.

Introduction

Cercospora leaf spot (CLS) is a minor but reoccurring disease problem on sugar beet grown in Idaho, Oregon and Washington. In production areas with warm humid summers such as Europe, the United Kingdom, and parts of North America, CLS is considered the most destructive foliar disease affecting sugar beet. Disease severity increases with warm, humid conditions in combination with leaf wetness for periods longer than 11 hours. Under severe disease pressure losses up to 40% or more are not uncommon when not controlled by fungicide applications (figure 1). Crop losses include decreased tonnage and percent sucrose as well as increased losses during storage. In addition, increased impurities and decayed roots reduce sucrose extraction during processing.

Symptoms

Initial symptoms of CLS are most commonly found on older leaves and petioles.

Numerous circular spots (figure 2) ranging from 2/100 in (0.5 mm) at early infection to 2/10 in (6 mm) at maturity can be observed. Individual lesions have a brownish to reddish purple border and a tan to light brown center (figure 3).

Under high relative humidity, the color of the centers can turn to a gray shade due to the production of conidiophores producing conidia. Lesion size and color is a distinctive feature of Cercospora leaf spot. CLS can be distinguished from Alternaria, Phoma, Ramularia and bacterial leaf spots (figure 4), since CLS leads to smaller circular to oval shaped lesions with black spore bearing pseudostromata (figure 3) in the middle.
As disease progresses, individual spots will coalesce and form large areas of necrotic tissue (figures 2). This goes along with a change of leaf color from healthy green to yellow and resulting in an overall brownish color associated with necrotic and dead leaf tissue (figure 5).

**Causal organism**

*Cercospora beticola* Sacc the causal agent of CLS is a necrotrophic, imperfect fungus without known sexual transfer of genetic material.

Genetic diversity within populations is facilitated by hyphal anastomosis. During anastomosis hyphal branches of two different colonies fuse, which allows for the exchange of genetic material. Hyphae are glassy to pale brown in appearance and septated. Interwoven hyphae growing intercellularly, eventually allow for the exchange of genetic material.

**Disease cycle and epidemiology**

The causal pathogen *C. beticola* will survive as conidia and pseudostromata on infected leaves and petioles in sugar beet debris and on plants of the current season crop. Common weed hosts for this pathogen include lambquarters, pigweed, mallow, and bindweed. The pathogen can also be found on safflower and crops closely related to sugar beet such as table beet, Swiss chard, and spinach. Pseudostromata allow for long-term survival (1-2 years) whereas conidia can only survive for 1-4 months. Conidial germination and production require warm (68 to 79 °F) and humid conditions (98% relative humidity or free water). Once released from conidiophores, conidia can be spread by splashing water (rain or overhead irrigation), insects, workers or equipment. In addition, conidia can be dispersed...
by wind for distances up to 300 feet. Conidia deposited on a suitable host can penetrate the leaf surface directly or invade open stomata. Once C. beticola colonizes internal leaf tissue the production of phytotoxins such as cercosporin and beticolin as well as hydrolytic enzymes will weaken the host cells which will eventually result in cell death.

Cercospora leaf spot is a polycyclic disease and depending on temperature, light, and host physiology (plant age and tolerance) an infection cycle can be completed within 7 to 21 days. Optimum conditions include temperatures ranging from 77-95 °F with approximately 5-8 hours of free moisture or above 90% relative humidity. The infection cycle will be shortened with increased temperatures and susceptibility of the host but will slow down when temperatures exceed 98 °F or drop below 60 °F.

Management

Under Idaho, Oregon and Washington conditions CLS is normally not of economic importance. Rarely will the disease reach thresholds that would warrant fungicide applications especially in fields that are being treated for powdery mildew (please consult PNW 643 for more information about this disease). However the use of susceptible varieties, conducive microclimates and local reoccurrence of CLS might make it necessary to implement management practices.

Cultural practices

Pseudostromata and conidia of C. beticola are not very competitive when exposed to soil microbes. To reduce primary inoculum, infected leaves and petioles should be plowed under to encourage decomposition. In addition, newly planted crops should be separated at least 300 feet from previously infected fields and a minimum 3 year crop rotation should be implemented.

The infection with C. beticola is highly temperature and moisture driven. In areas with severe CLS pressure it is advisable to reduce plant density to promote air circulation which will minimize leaf wetness. Additionally, overhead irrigation should be scheduled to avoid irrigation during the night and to allow plant canopy to be dry by night.

Disease monitoring and timing of control measures

The strict requirements of C. beticola on temperature and humidity for germination and infection make it an easy target for scouting and prediction models. Production areas in MI, MN, ND, as well as CO, NE, MT, and WY rely on prediction models such as BEETcast or DIV (daily infection values). These models take relative humidity and temperature into consideration when predicting potential periods for disease development. The current CLS pressure and disease severity in ID, OR and WA does not warrant the development of such a prediction model. However, it is advised in areas with a known history of CLS to monitor environmental conditions and to scout for symptoms. Scouting should commence at canopy closure but normally not earlier than the first week in July.

Chemical control

Fungicide applications are normally not necessary for the control of CLS. As mentioned earlier, light infestation is most likely controlled by fungicide applications made to manage powdery mildew. Areas with a potential for heavy infestation should be considered for fungicide applications. The likelihood for severe infection will increase with preexisting inoculum, predicted environmental conditions favoring infection and varietal susceptibility. Applications of a systemic or contact fungicide should be made at the earliest observed onset of CLS. Good crop coverage is essential for effective control of CLS. Fungicides should be applied with enough water to ensure good coverage.

Fungicides belonging to the following groups provide acceptable control of CLS:

- Cell-respiration inhibitors (QoI) (strobilurins, Group 11)
- Cell-respiration inhibitors (organo tin compounds) (fentin hydroxide, Group 30)

In addition, other growing areas suggest the use of Demethylation inhibitors (DMI) (triazoles, Group 3). But fungicide resistance screens of Idaho C. beticola isolates revealed moderate to strong resistance to chemicals within this group.

For current availability of fungicides and proper rates, check with local crop consultants, chemical company representatives, Cooperative Extension Service representatives, or the annually revised Pacific Northwest Plant Disease Management Handbook (http://pnwhandbooks.org/plantdisease/). Be sure to read and follow all label information.

Tolerant varieties

Many production areas outside of the Pacific Northwest require moderately to highly tolerant varieties. The level of tolerance expressed in the field may vary, depending on environmental conditions, fertilization and water management, and overall plant health. Still, disease development in a tolerant variety is usually slower than in susceptible varieties and will not reach the same level of severity. To further reduce the severity, tolerant variety should be used in combination with foliar applied fungicides.

Currently, the disease pressure in Idaho does not warrant the use of tolerant varieties. However, the increase of fungicide resistant isolates and the lack of other management tools might make it necessary to employ genetic tolerance to minimize the effects of CLS.
Further reading

**Glossary**

**Anastomosis.** The fusion between branches of the same or different hyphae leading to a hyphal network for the exchange of genetic material.

**Conidiophore.** Asexual spore-bearing structures consisting of simple or branched hyphae.

**Conidium** (plural = conidia). An asexual spore produced on a conidiophore.

**Hypha** (plural = hyphae). Tubular filaments that form the body of a fungus.

**Mycelium** (plural = mycelia). Mass of interwoven hyphae forming the body/colony of a fungus.

**Nectrotroph.** An organism that kills surrounding host cells to obtain its energy from them.

**Pseudostromata.** Interwoven hyphae forming a cushion-like mass (stroma) in which spore bearing structures are formed.

**Septum** (plural = septa). Cross walls or partitions in hyphae.

**Glossary**

Systemic fungicides are products with active ingredients (a.i.) which can be translocated within the applied leaf and in certain cases throughout the whole plant. This feature allows the product to reach and protect areas that are not initially contacted by the chemical. Most systemic fungicides possess preventative and curative properties that extend for a longer period of time. However, the high specificity (single site activity) of the a.i. can lead more easily to fungicide resistance in the target organism. Following established resistant management protocols including rotating fungicide groups will be important.

Contact fungicides need to be in direct contact with the target organism. These products need to be applied before the pathogen is deposit so they can form a protective layer on the leave surface. In comparison to systemic fungicides, these products are prone to being washed off by rain and irrigation water. Therefore, good coverage is a must to ensure overall protection. Contact fungicides possess no curative action and are generally less effective. However, contact fungicides are less likely to develop fungicide resistance because of their multisite activity and are typically less expensive.
According to the glyphosate labels for weed control in Roundup Ready sugarbeets, the time to apply glyphosate for best results is before the weeds exceed 2-inches tall. Is it possible growers have become too relaxed in their application timing? In the first few years that this technology was available, nearly all of the beet fields were clean of weeds. Probably the most common application issue was the weeds that escaped glyphosate’s full effect were those in the wheel tracks of the sprayers; and this was as short-live problem as we figured out how to work around this challenge. However, in the past couple of years, it seems that there are more fields where the weed control is not as good as it was when this technology first became available in 2008. Also, some growers are still trying to use up the last of the Betamix herbicide they acquired a few years ago when there was a concern for the loss of Roundup Ready sugarbeets seed.

A field experiment, funded by the Idaho Sugarbeets Growers Association, was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho with the following objectives: 1) evaluate the timing of glyphosate applications for weed control in sugarbeets and 2) compare various rates of Betamix used in combination with glyphosate on the effects of crop injury and weed control. The Betamix tank mix combinations with glyphosate was of interest because of grower concerns over crop injury in sugarbeets. Betamix may also be a product to continue using as a common lambsquarters resistance management tool. This experiment was set up with an untreated control four replications in a randomized complete block design. Individual plot size for each treatment was four rows by 30 ft. The sugarbeets variety ‘Holly Hybrid SX1502RR’ was planted April 17, 2014, in 22-inch rows at a rate of 60,590 seed/A. Several weeds were present in this study and included common lambsquarters, redroot pigweed, kochia, and green foxtail. All of the herbicides were applied with a CO2-pressurized bicycle-wheel sprayer calibrated to deliver 15 gallons per acre using Teejet 11001 flat fan nozzles. Additional environmental and application information is given in Table 1. Crop injury and weed control were evaluated visually 13, 55, and 104 days after the last herbicide application (DALA) on July 2, August 13, and October 1, respectively. The two center rows of each plot were harvested mechanically on October 7.

Kochia, common lambsquarters, and redroot pigweed were the most prevalent weeds present after green foxtail. Crop injury 13 DALA with the Betamix treatments was minor and ranged from 1 to 5% in all treatments (Table 2). By 55 DALA, no injury was observed in these same treatments. Common lambsquarters control with the Betamix + glyphosate combinations provided better season-long control with the 24 and 32 fl oz/A rates of Betamix compared to the 40 and 48 fl oz/A Betamix rates. Other treatments that controlled common lambsquarters throughout the season included: 1) glyphosate at 22 fl oz/A + AMS at 0.85 lb/A applied preemergence (PRE) fb glyphosate + Outlook at 32 + 21 fl oz/A and AMS at 0.85 lb/A applied at the 4-leaf stage fb glyphosate + AMS applied at the 6-leaf stage; and 2) glyphosate + Outlook at 32 + 21 fl oz/A and AMS at 0.85 lb/A applied at the 2-leaf stage fb glyphosate + AMS alone with the same rate at the 4-leaf stage. Kochia was controlled 89% or better at the end of the season with no significant difference among herbicide treatments. Redroot pigweed control ranged from 80 to 99% over all of the evaluations dates with no significant difference among the treatments at any of the evaluation dates. Green foxtail control 104 DALA ranged

<table>
<thead>
<tr>
<th>Table 2:</th>
<th>Environmental conditions and weed species densities at application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application timing</td>
<td>pre-emergence</td>
</tr>
<tr>
<td>Wind velocity (mph)</td>
<td>2</td>
</tr>
<tr>
<td>Cloud cover (%)</td>
<td>5</td>
</tr>
<tr>
<td>Time of day</td>
<td>11/40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kochia</td>
<td>99</td>
<td>98</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Redroot pigweed</td>
<td>97</td>
<td>96</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Yield</td>
<td>91</td>
<td>94</td>
<td>90</td>
<td>90</td>
</tr>
</tbody>
</table>
from 50 to 98%. Glyphosate at 32 fl oz/A + AMS at 0.85 lb/A applied at the 4-leaf stage fb glyphosate at 22 fl oz/A + AMS at 0.85 lb/A applied at the 6-leaf stage provided only 50% control.

The most effective overall weed control treatments included: 1) glyphosate at 22 fl oz/A + AMS at 0.85 lb/A applied pre- emergence (PRE) fb glyphosate + Outlook at 32 + 21 fl oz/A and AMS at 0.85 lb/A applied at the 4-leaf stage fb glyphosate + AMS applied at the 6-leaf stage; 2) glyphosate at 22 fl oz/A + AMS at 0.85 lb/A applied at the 4-leaf stage fb glyphosate + Outlook at 32 + 21 fl oz/A - 1) glyphosate at 22 fl oz/A + AMS at 0.85 lb/A applied pre- emergence (PRE) fb glyphosate + Outlook at 32 + 21 fl oz/A - 1) glyphosate at 22 fl oz/A + AMS at 0.85 lb/A applied at the 4-leaf stage fb glyphosate + Outlook at 32 + 21 fl oz/A and AMS at 0.85 lb/A applied at the 6-leaf stage; 3) glyphosate + Outlook at 32 + 21 fl oz/A and AMS at 0.85 lb/A applied at the 2-leaf stage fb glyphosate + AMS alone with the same rate at the 4-leaf stage.

Sugarbeets root yield ranged from 6 to 56 ton/A with the untreated control having the lowest yield. All of the herbicide treatments had statistically equal yields. The higher yielding treatments ranged from 49 to 56 ton/A. Estimated recoverable sugar (ERS) yield ranged from 1,166 to 11,190 lb/A and basically followed the same pattern as root yield.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Application rate</th>
<th>Application date</th>
<th>Crop injury</th>
<th>C. lambsquarters</th>
<th>Kochia</th>
<th>Redroot pigweed</th>
<th>Green foxtail</th>
<th>Root yield</th>
<th>ERS³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Un-treated control</td>
<td></td>
<td></td>
<td>7/2</td>
<td>8/13</td>
<td>10/1</td>
<td>7/2</td>
<td>8/13</td>
<td>10/1</td>
<td>7/2</td>
</tr>
<tr>
<td>Glyphosate + AMS</td>
<td>22 fl oz/A, 0.85 lb/A</td>
<td>6/19</td>
<td>1 b</td>
<td>0 a</td>
<td>0 a</td>
<td>94 a</td>
<td>97 a</td>
<td>98 a</td>
<td>97 a</td>
</tr>
<tr>
<td>Glyphosate + AMS</td>
<td>22 fl oz/A, 0.85 lb/A</td>
<td>5/22</td>
<td>0 a</td>
<td>0 a</td>
<td>0 a</td>
<td>95 a</td>
<td>97 a</td>
<td>98 a</td>
<td>97 a</td>
</tr>
<tr>
<td>Glyphosate + AMS</td>
<td>22 fl oz/A, 0.85 lb/A</td>
<td>6/7</td>
<td>0 a</td>
<td>0 a</td>
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<td>95 a</td>
<td>97 a</td>
<td>98 a</td>
<td>97 a</td>
</tr>
<tr>
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<td>22 fl oz/A, 0.85 lb/A</td>
<td>6/19</td>
<td>0 a</td>
<td>0 a</td>
<td>0 a</td>
<td>95 a</td>
<td>97 a</td>
<td>98 a</td>
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</tr>
<tr>
<td>Glyphosate + AMS</td>
<td>22 fl oz/A, 0.85 lb/A</td>
<td>5/1 &amp; 6/7</td>
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<td>0 a</td>
<td>0 a</td>
<td>95 a</td>
<td>97 a</td>
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</table>

Means followed by same letter are not significantly different using Fisher’s Protected LSD (P=0.05).

²Glyphosate used was Roundup PowerMax. AMS = ammonium sulfate and sold as BroneMax. Fb = followed by.

³ERS is estimated recoverable sugar.
White Satin Sugar

SUGAR CONTENT ANOTHER 1/2%

ASK ME HOW

ASK YOUR WHITE SATIN FIELD STAFF