ON FARM RESEARCH GUIDE

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Compiled by: Sharon Rempel,
Organic Crops and Seeds Researcher

For: The Garden Institute of Alberta,
Box 1406, 5328 Calgary Trail,
Edmonton, Alberta T6H 4J8 Canada.
Phone: (780) 461-9958; fax: (780) 469-6314;
email:slrempel@shaw.ca

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Main Office Executive Director, Theresa Podoll
9824 79th St SE Fullerton, ND 58441-9725
Phone & Fax: 701-883-4304
email: tpnpsas@drtel.net

Branch Office
Program Director, Tonya Haigh
20453 460th Ave. Bruce, SD 57220
Phone & Fax: 605-627-5862
email: trhaigh@dakota.net

Introduction

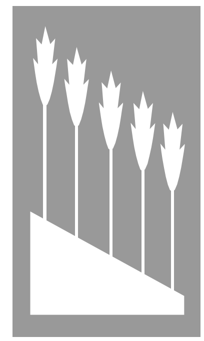
Before the days of university and government plant breeders and gene banks, farmers were the guardians of seed and selectors of varieties of crops. Developing a link with the plants in the field or garden, and intuitively and cognitively selecting certain samples from within the growing population is how ‘new’ varieties have been developed for centuries.

The environmental conditions exert an influence on the seed generation after generation.

The farmer’s selection pressure also helps direct the way the evolution of the variety takes in the field. But ultimately it is the genetics within the seed that determine how the plant will grow and survive.

Modern organic plant selection work strives to match plants to their growing environments, finding a situation where the plant variety optimizes the growing conditions and THRIVES, not just survives.

Heritage varieties of plants offer a diversity of genetic opportunity to farmers. Developed at a time before high input chemical farming these may thrive in modern organic fields. We need to experiment to find out.



Great research begins with a great idea

A farmer's intuition and experiential knowledge are valid and vital ways of knowing, but research is about measurements as well as observations. As a farmer makes the daily rounds, noting details about vigor and height and disease and other observations, he or she is taking ‘field observations’. Recording this information in a book is taking ‘field observations’ and compiling the observations into a conclusion at the end of the season and taking action based on those decisions is what farmers do quite naturally.

To do more formal research, or to share ideas with others there is need to establish some basic questions and methods that will provide observations and conclusions that will provide satisfactory ‘data’ for others to use in making conclusions.

Consider what questions you want answered. Can your farm provide a place to answer the questions?

Farm-based research is limited only by your imagination. The type of project -- be it crops, livestock or marketing will help determine the design of the experiment.

Whether you are making the transition to another production system, comparing varieties or testing a new marketing strategy, conducting research will require an investment of time and energy.

Of all your ideas, choose one or two simple hypotheses that will yield the greatest return of practical information. Don’t get discouraged! Great research begins with a great idea.

“ON FARM” PARTICIPATORY RESEARCH

True ‘on-farm’ research involves producers in experiment design, often in collaboration with scientists or extension educators. Farmers and ranchers either conduct or help conduct the experiment, providing a real-life setting in which to test their theories.

‘On-farm’ research, particularly if farmer-driven, can solve problems with solutions that keep more of the decision-making in the farmer's hands. In contrast to research conducted at experiment stations, which run trials in tightly controlled settings, ‘on-farm’ tests demonstrate how real-life factors such as different soil types, plant populations and pests affect a new practice or system.

In many areas, groups of farmers or ranchers have banded together to conduct on-farm research about a topic of interest. Farmer research teams work especially well when university or nonprofit organization researchers join as part of a "participatory" research team.

The power of participatory research comes from combining the creativity, experience and resources of many people to address a common problem. The data that results from trials conducted on several farms across several years also is more reliable and more trustworthy than a few replicated trials conducted at one or two locations during just one year.

While farmers gain a greater understanding of their unique production systems and learn to use simple research methods to answer questions on a range of topics, researchers benefit from conducting research in the "real world" context of working farms and with farmers.

The “participatory’’ research model values both farmer and scientific ways of learning, effectively integrating them to generate new knowledge for more informed production and management decisions.

By collaborating with university or researchers, farmers benefit from their technical experience in research design, data collection and analysis.

Despite good intent, farmers conducting on-farm research often find other time-consuming activities during the growing season prevent them from taking data at the proper time. Collaboration with someone off the farm who has the time to take the observations may solve that problem.

PRACTICAL IDEAS FOR WHAT DATA TO COLLECT AND HOW:

Example: In a North Dakota/ Minnesota trial of hard red spring wheat and oat varieties on organic farms, the following information will be recorded for each plot and variety.

- seed germination (sample tested before planting),
- seedling emergence,
- canopy closure,
- weed pressure,
- plant height,
- lodging,
- disease,
- heading plant biomass,
- yield,

Equipment Required to:

- test weight,
- protein,
- percent moisture,
- gluten strength.
- soil nitrogen, phosphorus, potassium & organic matter levels (soil tested before planting),

Most observations can be made without training and equipment.

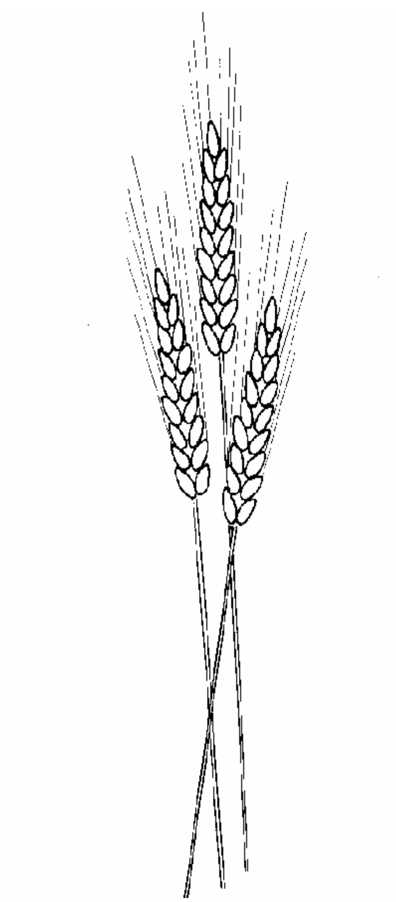
When you are comparing varieties, it is often the relative score that really matters. In other words, what you may want to know is what looks best in your field, what looks average, and what looks worst.

Absolute measurements such as the lumens of light which reach the ground in a certain plot may be less important to you than which variety has a canopy that covers the most area, and which variety's canopy covers the least area.

A farmer recently learned the following method for making comparative measurements. Let¹s say you are measuring weed competitiveness (in a field where you are sure that weed pressure was fairly uniform among plots to begin with).

Take a look at all of the plots in one replication (one plot of each variety, if this is a variety trial). You have a scale of 1 to 9 to work with. The plot that you think has the fewest weeds gets a 9 (even if that plot, absolutely, has lots of weeds!). You are making relative measurements.

The rest of the plots should get rankings of 3, 5, and 7, based on how weedy they look compared to the "9" and the "1". Just use the odd numbers, not the even. Now you have a comparative measure of least weedy to most weedy, in about 10 minutes, without a light meter or other expensive equipment.



Modify this to meet your own needs.

The farmer notes, "This design incorporates important knowledge of how the human brain works to give a statistically useable result."

This method works well for other comparative data, such as seedling emergence (which plot has the most seedlings on a particular day, which plot has the fewest - eyeball this), canopy closure, lodging, disease, etc.

Other data, like heading dates, you can take by just going out to your field every other day about when the plants should be heading, and observing which varieties head out on each day.

Now you¹re left with just a few data sets (yield, protein, test weight, moisture) that need to be done in cooperation with a research center or grain buyer.

A final note: make the observations that are important to you.

BASICS OF EXPERIMENTAL DESIGN:

STATISTICS

Although given a position of esteemed power, statistics can be made to show pretty well anything the researcher or statistician wants to prove.

There are some very basic considerations in laying out a project design that will meet the scrutiny of any researcher and make your research ‘science’ and will be accepted as ‘good science’.

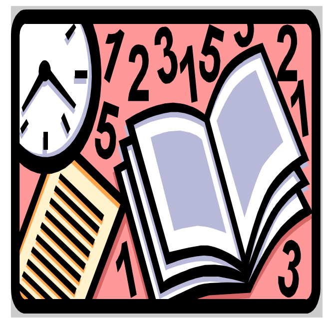
Statistics are used to calculate the odds that what you are measuring on one part of the farm will be ‘true’ for other parts of the farm.

So, measurements must be taken systematically. Consulting with someone familiar with statistics while you are designing the experiment is a good idea; government statisticians are able to help, extension agents, university researchers, etc.

To reduce variation within the natural world and make a sound observation, research demands rigid standardization. This helps ensure that observed differences are more likely to be caused by treatments or varietial differences.

Establish research plots on relatively uniform ground and treat all plots exactly the same except for treatments you are testing.

Experiments are done on portions of the farm. The data may not be relevant to other parts of the farm.



READY TO DESIGN THE EXPERIMENT:

1. Start off with a good question and form a hypothesis.
2. What’s a hypothesis? Focus your larger question into a well-defined question or statement that can be answered with data. This is the hypothesis, a testable statement that forms the basis of the experiment.
3. Research is to measure a controlled part of the system in order to make generalization or predictions about the whole. Example hypothesis; Use of straw as a mulch when applied as a thin layer after transplanted tomatoes are in the ground reduces weeds and will increase the soil nitrogen.
4. Test the hypothesis. That means doing the experiment. Figure out what you need to measure, planning how to collect and analyze data.

VERY IMPORTANT:

1. Keep the experiment easy to maintain.
2. Get steps right before you start so you have results that are meaningful.
3. Select priorities. Does the project address a priority need? Is the project doable?
4. Decide what size plots should be and where they fit best. One field length and one or two tractor passes wide makes it easy to deal with a strip of field, if doing treatments.
5. If comparing treatments make sure each pair of plots runs across uniform areas of the field. Use plot buffers of 6-12 rows of crop around the field trials to protect from run off or drift. These help show the results of a treatment from natural variation effects.
6. Random sampling and sample sizes should be determined using statistical methods if you wish to publish your results in an academic journal. Otherwise you can do what time and plot size dictates; you trade a degree of accuracy in a larger sample size with time and money.
7. In order to get ‘good statistics’ Replication and Randomization and possibly a Control are necessary.

Replication: You know yields vary year to year. Yield often varies location to location in a field. This natural variation is why replication is necessary. The more times a treatment is duplicated the more likely it is the measurements reflect the effect of the treatment than natural variation in the field. Four replications are standard in university based research. Between four and six is adequate for 'on farm' research work.

Randomization: The order of treatments can't be the same in each replication.

Control: Control plots where the treatment isn't applied; this gives you a basis for comparison. If you are researching an input, the control plot would not have the input. In fertility studies the control doesn't receive fertilizer. You don't need a control in doing variety trial work.

Summary:

1. Develop the research question and null hypothesis (a hypothesis of no effect, eg: there is no difference between varieties x,y,z when grown on 3 organic farms in the Peace River area of Alberta.)
2. Decide what measurements will be taken, by whom, and how to collect data. Put the data that will be collected into the project protocols.
3. Develop a time frame to get the results.
4. Get a second opinion on the experimental design so the idea and layout can be seen with different eyes.
5. Check with a statistician to ensure the project is going to produce good statistics and be accepted by scientists and researchers.

Taking Measurements

You can measure anything you like. What was your original research question, and what observations and data do you require to answer that question? You might want to note when various growth stages are reached, plant height, leaf numbers, weed counts, and other field data.

After harvest you may wish to get the yield, quality observations such as protein, insect damage, moisture, test weight, etc. Be sure what you measure is useful to your research question of WHY are you doing this experiment. Most agriculture research focuses on measuring yield and quality.

If you are intended to select seed from a variety to develop your own 'strain', you might wish to flag various heads with a little bit of colored yarn, so you can harvest those heads separately.

Qualitative Scoring and Observation Notes vs Quantitative

Quantitative rating works best for those traits which are unseen and measured easily such as protein content, test weight, or falling number.

For those agronomic traits and qualities such as height, stability, weed competitiveness, early vigor, early canopy closure, beauty, resistance to weathering at harvest, seed size, seed color, hardiness, disease resistance – anything which is important to farmers in the field, qualitative scoring works best. Qualitative scoring can be used with a group of individual plants or a group of varieties in an observational plot or replicated trial.

A simple, effective and statistically accurate procedure for qualitative scoring uses a 1 to 9 scale:

1. Use the numbers 1,3,5,7,9 only. All these numbers can be used or only 1,5 and 9.
2. Walk and observe the trial or a replication first with the specific trait or traits you are rating in mind. It is important to view all the individuals or varieties together, not separate from one another. Stand back if you need to.
3. Find the best individual or variety and give it a 9. Find the worst and give it a 1. Find the middle and rate it 5. Others can receive 3 or 7 rating. If two are equally good, they both can receive a 9. If a group of farmers is gathered at a research plot for a field day, one may do a group scoring with equal (or perhaps better) results by deciding together which gets a 9 and which gets a 1.

Try the procedure first, with an easy character such as height. If you deem height to be important for weed competitiveness and bio-mass production, then the tallest will be given a 9 and the shortest a 1. Score relatively fast, don't think too much. Farmers, let your senses and intimate gut knowledge of the crop come to the fore. If a more difficult rating is giving you trouble, stand back and let your senses observe, observe, and observe. For instance, if a whole population (all the varieties) are diseased, which is the least diseased? This is your 9. Using scoring in this way maybe particularly valuable when doing selection and breeding work for durable disease resistance.

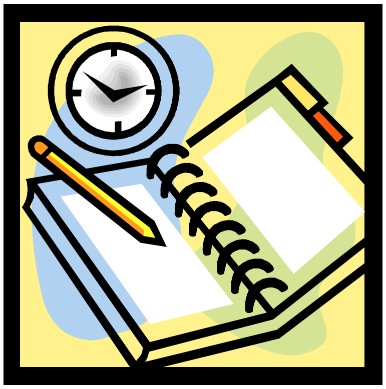
An equally valuable adjunct to a strict rating system is observational notes. Making notes all season of what you see- from planting to harvest, helps to develop an intimate relationship with the plants/varieties. Spending time with the plants while making notes often leads one to see things which may have been overlooked, or may help explain an outcome. Observational notes may be critical in the correlation of data from both quantitative and qualitative ratings.

Questions about doing research work?

Ask your local Applied Research Association for some advice but you have the basics. If you want to do fertilizer comparison, the same basic concept of replication takes place. You are just adding in another variable if you are combining fertilizers with varieties. You will need a plot that has nothing added, a control, included in the planting plan.

Ask a Government Specialist in the area you are working and maybe even one of the Statisticians to take a look at your ideas before you spend time and money on the work.

RECORD KEEPING:



You must keep good notes!!!

- Research results are in the details, and repetition and documentation is critical. Documentation allows you to duplicate the experiment to verify it, and gives a record to see what went right or wrong. These are the details.
- Keep a notebook dedicated to the research project.

- Compile a field history of five years for the site, including crops grown, tillage operations, inputs and yields. Past management can strongly affect the present performance and provide details why things worked out as they did. (As an organic farmer you will already have these details; give yourself a pat on the back for having this step done already).

RESEARCH GENERALITIES:

Two Basic Research ideas:

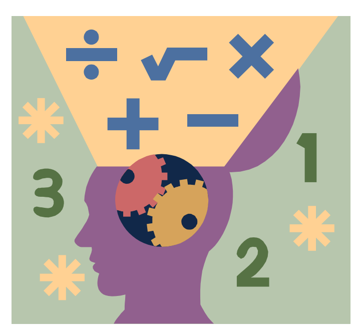
1. **Applied Research:** provide data to support existing knowledge or develop new methods. This requires proper study design, management, data collection and analysis to obtain statistically sound results. This might include Variety Trials, where you compare modern and heritage varieties of a crop.
2. **Demonstrations:** show people how a practice or crop works under local conditions. These do not require detailed measurements to assess their results; they are clear from observations. This might be a plot where you just grow out different varieties so people can see the differences in the varieties. This might be a Demonstration Plot where people come to see the crops.

Types of Experiments:

1. Variety trials
2. Agronomy trials
3. Experimentation with perennial crops
4. Pasture experiment 'on farm' demonstration research trials (shows differences between whatever you wish to show)

Key Steps:

1. Try and identify an opportunity
2. Find something that leads to a hypothesis
3. Propose an experiment to test this hypothesis
4. Carry out the experiment and collect data



DATA COLLECTION:

Data collection records should include:

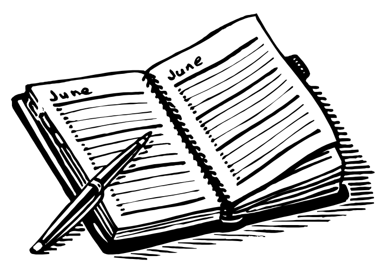
a) Soil details: moisture at seeding, topography, soil type, soil test
b) climate: rainfall (buy a gauge); weather (*a cheap weather station is about $1000); temperature; wind
c) environment: weeds, insects, diseases, crops and management history
d) Seeding conditions including type of seeder, row spacing, soil temperature, residue level
e) Record the pressure, density, severity of damage of pest or disease

Collecting data:

1. Standardization of the field record keeping books used at each site.
2. Use standard procedures and formats.
3. Standardize record keeping protocols and systems (will one person be responsible per site, etc).
4. Calibration of equipment
5. When doing work documentation and precision is more important than speed. DATA IS COSTLY to collect. It is really important to have a record book that records everything and all observations.
6. Scales need annual calibration.

Data validation:

1. Check for missing data (that's why the field book is really important)
2. Use moisture and market standards for data correction
3. Plot size including spacing x row x plot length



PLANNING A FIELD EXPERIMENT:

1. Start organizing ½ to a year before to identify the best people to work on the experiment, investigate the field sites and find funding to do the experiment.
2. What do you hope to prove in this experiment? (objectives)
3. What are the benefits of this project – significance to farmers, economic benefits, amount of interest by local people, etc.

Writing up a Budget is important; identify all inputs required to do the experiment (seed, equipment, labor at all stages, signage, record keeping, soil testing, keeping birds away, etc) All experiments take time and money to set up and conduct. You might want to ensure you have the equipment and labour you need for the critical stages : field preparation, plot layout, seeding, weeding, taking regular (daily? Every three days?) records, harvesting, threshing, bagging and labeling the harvest.

Collaborating with some other farmers: If you are going to work together with some other farmers who will plant the same crops on their place and you will compare results, then **make sure you standardize the seed lots**. Make sure you take the seed you'll plant on your place from the same seed lot or sack they are using to eliminate the variables that come in from using different seed lots. Finding the seed and sending it around must be considered in the time frame. You probably want to use the same planting design (see next item) on each site and determine before planting what observations you will each make during the growing season, and how you will share your results.

PLOT PLANS

PLOT PLAN.. map of what is planted where….and how to find it at the end of the season….

It is useful to have a plot map or plan to visualize the project and keep track of what is where, and any treatments and where they are applied. Make sure any changes you make to your experiment are recorded on the plot map.

Make a duplicate copy of the actual site map. Keep a copy of the map somewhere safe, and have a working copy that you write on and by the end of the season will have rain drops, dirt and various scriblings on it, some spilt coffee, making the original information nearly illegible. Go back to the original plot map, and pat yourself on the back for making a spare. As your memory won't remember why the marker stake doesn't jive with the map, you will be grateful that you updated the plot map after you finished the planting.

Plot Management:

1. Site preparation really important including calibration of the equipment regularly.
2. Staking
3. Seeding
4. Fertilizer application
5. Pesticide application
6. Harvesting
7. Good Signage to let people know what's happening in the plots

PLOT LAYOUT:

1. Replications are important. Decide your plot size and shape. This might be determined in part by the type of equipment available.
2. A good design and layout helps minimize the 'noise' of differences in the soil, topography, moisture content of soil, etc.
3. A field map is good, as well as plot plans and a map showing landscape variability. Old soil survey maps are handy too. An aerial photo of the plot will show a lot too.

Site selection is really important:

1. Uniformity between plots is really important.

Site and plot data:

1. Get the site history including crop rotations, tillage practices, fertilizer applications dates and methods, available soil moisture at time of planting and depth of moisture
2. Collect data on the soil moisture at the time of planting, as well as depth of moisture.

<u>How will the experiment be planted?</u>

1. Strip design. In this strip two or three samples will be taken from within the strip.
2. Randomized block design. (used for yield data collection for example).

<u>Choice of Site:</u> This decision makes or breaks a project. When selecting the plot think about:

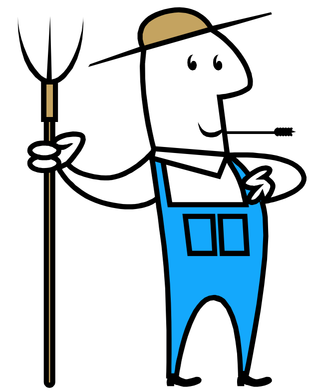
1. Soil variability (texture, salinity, chemical and fertilizer history, turn-rows, former fencelines and boundaries) Select a uniform site for your plots.
2. Site topography (if you have to plant on a slope do it mid way down)
3. Site drainage (don't plant where parts of the field will be waterlogged)
4. Site access (easy for machines and if you have a field day can cars get close)
5. Site visibility (do you want people to see the plot or keep it 'out of site')

These can be decided upon before the planting season. You can also make **signs** for each variety. It is useful to make easy to read wooden signs. Use the Sharpie BLACK not red or blue or green to write your signs. The stakes you might buy for tomatoes work fine.

Line up equipment and paperwork well before harvest date so you are ready. Make a data sheet where you can record the information you gather. You might want to assign a # to each plot on the map.

If you have done replicated plot trial work, this is vital. Note the harvest area from each plot so plot yields can be converted to pounds per acre. NEVER lump all the yields from one treatment together; keep all plots separate.

To avoid margin effects select a center row to harvest from each plot to get the most accurate results, and also this is very useful when saving seed. The center is least likely to have any cross pollination from the neighbour plot.



Harvest and planting and threshing:

Make sure you really clean out the equipment before starting the experiment and after each variety. Make two tags for each variety; one for inside the sack another outside the sack. If the outside one's torn off or fades, you have your backup one in the sack.

Don't use the same equipment to seed GM crops as you use for organic field work. Ideally use two different sets of equipment.

Ideally steam clean the equipment or ensure that the equipment hasn't seeded a GMO field before seeding the organic plots

Remember that there is a ZERO tolerance to GMO in organic food production at all levels.

After threshing each variety, use compressed air to blow out the equipment. A few seeds will multiply out over generations and contaminate the lot.

FIELD DAY:

If you are not worried about observing how a variety competes with weeds, then you might want to plan to weed the plots. If your intention was to multiply out seed, then weeding is a good idea, but do it while the ground is not hard rock dry. If you are going to have a Field Day it's like having company come to your place. Spruce up the field, make sure the edges of the plots are well defined, make sure signs are upright and easy to read and clear away any debris that might trip or injure a visitor.

At the end of the experiment, you might want to share your information with others. Write a Summary of the project in about half page or less, highlighting the progress and results. Explain in the Background and Objectives the purpose of the experiment. Outline the project design in Methods, and provide enough detail someone could go and do what you did. In Results, describe the results. Conclusions are where you sum up the work and results.

Photos can be taken during the growing season to provide records of visual responses. If you use slides you can use these for a presentation at the local meeting, or even send these with an article you write for a magazine. Slides are handy, good for presentations and publications.

Field Day:

Will you invite others to visit the plot during the growing season or will you have a Field Day? Having a lunch with the Field Day is a good incentive for others to come, and gives a chance for informal visiting to discuss what's growing. Avoid scheduling this during the busy times and avoid conflicts with provincial field days or tours and major sporting events in the community!

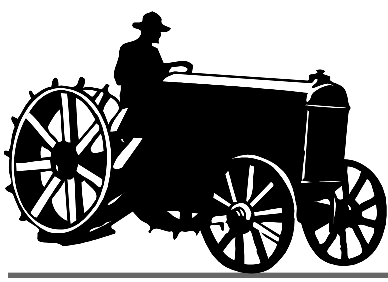
Let the local paper, radio station and t.v. know about your field day.

Field Day Success List:

- Laying out the site to allow easy access by visitors
- Use easy to read signs in plots (use small case lettering for easy reading, not upper case)
- Tidy up the plots before field day (you know how the house is cleaned up before company comes??)
- Teach through food; if you are organic, then provide access to local organic food for lunch or snacks
- Having handouts with varieties, plot layout and other details allows visitors to listen not write
- If possible provide access to shade when stopped for a talk or lecture
- Good signage on the major roads to the site
- Provide an opportunity for people to talk amongst themselves while in the plots
- Provide an opportunity to do the Qualitative Evaluation exercise together
- Provide straw on the paths in case it rains
- Advertise well in advance
- List a contact person accessible the morning of the event by phone
- Provide a media information sheet in advance and at the event so media will get the facts straight
- Be proud of the work you've done and happy to share what you've learned with others. Have fun!

Our Organic Agriculture Grassroots

The grassroots of organic agriculture remind us about diversity within our human population and within our farming practices and within our choice of varieties of crops to grow and eat. Diversity is security and goes directly against corporate uniformity. Diversity of a landrace is hard to control, so landraces are considered 'inferior' by seed legislators.



"Industrial science" provides an excuse to justify doing very immoral things in the name of research and worse yet to 'help humanity'. These words have been used to justify displacing traditional varieties of crops with high input demanding crops during the 1960s Green Revolution.

The same words are being used to push 'science' of Genetically Modified (GM) crops upon the food systems of the world all in the name of science and technology being the answers to all our problems. These are not answers. They are attempts to control people and the food supply for the good of a very few people at the top.

What value are 'heritage wheats' to modern farming?

All research begins with a basic question and a theory. For example if heritage varieties of wheats were developed during pre 'high input' agriculture eras on farms that were more or less like or modern 'organic' farms, does it not make sense that the old varieties of wheats could be grown on modern organic farms and produce good yields without chemicals?

Old varieties are not 'inferior' to be eliminated by 'superior varieties

The old varieties of crop plants are called 'inferior' by government people who support the position corporate industry tells them to take. The 'superior' plants are the high input hybrids and the patented seed. The old varieties of crops did not depend on chemicals to survive, nor are they patented yet, at least not obviously. The old varieties of all crop plants, and many of our garden varieties have provided good quality food for people and animals for centuries.

These old varieties are being controlled by corporations and governments through legislation (it is illegal to sell a non registered variety of wheat in Canada for example) and the CSGA is the only legislated body to determine what variety of wheat has 'merit' for putting on the variety registration list. The Canadian grading system doesn't permit 'variety preservation' which identifies the farm nor the variety being sold. These are control measures aimed to commoditize food and make farmers production units.

TRYING YOUR HAND AT GROWING OUT A VARIETY AND DOING SOME SELECTION:

Imagine you were given a sack of *Red Fife* wheat. You save ½ the sack, because if the crop somehow fails, and you don't know if anyone but yourself has seed, then you hold back some of the seed stock ALWAYS. Label the sack well. You've planted a field of *Red Fife.* It grows and you begin to see a few heads in the field that are really impressive. You pick those at maturity and put them in a sack or jar. Then you harvest the field.

Next season you plant the whole harvest (you still have the ½ sack you didn't plant as a reserve) and you also plant those few heads that caught your attention. You watch both the main crop and the selections. You again select the heads that draw your attention. If they look identical you might want to put them together (bulk them) but you may see great variability in the head, straw, seed etc. Good observation!!

Keep those lines separate from each other. Give them a name or a number. Next season, you will plant the main field with a few of the seeds of the 'good stuff' thrown back in to keep those characteristics alive in the main field, your living seed bank of that variety. And you might be finding that you've got a nice looking quantity of a different looking variety, so give it a name. Sharon's Fife is good as it was out of the Red Fife I did my selection.

That is how we've ended up with a lot of neat varieties from the 1800s and early 1900s. Just like that.

But remember that you have a gold mine of diversity in that main field so keep growing it and allowing it to adapt to the annual changes in weather. Remember that you've got that ½ sack of seed put away somewhere safe. Maybe you've got an old freezer that you can dedicate to seed saving. Ideally the container should of course mouse proof. All seed should be stored in a cool, dark and dry place.

Humidity and high temperature makes the seed die quicker. There is no hard and fast rule about what variety stays viable or able to grow for any number of years. It depends on the vigor in the seed embryo as well as the storage conditions.

At the end of the season, you will want to record the characteristics of the crop including seed color, head length, straw length, and whatever other characteristics are valuable to you or your end use user of the crop.

When doing protein and other quality testing you might want to talk to other researchers and see where they are having their material testing and then develop a standardized process and place for everyone's testing. We know that machinery varies place to place and comparisons aren't valid if they are being measured by two different types of equipment.

RESEARCH RESOURCES & NETWORKS

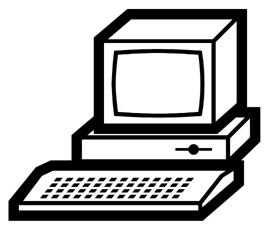
1. There is a Consortium of Organic Researchers in the UK. They meet often to develop protocols for organic research work. As with all research work there will be good research that is useful to everyday life and other research that justifies the researcher's life but is not much use to anyone else. It is up to you to understand what research is and what you can do to ensure you get the results you want on your farm.

2. More information about-Community Owned Seed projects can be found at website: **http://members.shaw.ca/oldwheat**

3. ***A Farmer's Guide to On-Farm Research*****,** by Rhonda Janke, Dick Thompson, Ken McNamara and Craig Cramer. A step-by-step guide to conducting on-farm research, using real-life examples from Dick Thompson's Iowa farm. $5 + s/h. Rodale Book Store, **(800) 832-6285.**

4. ***AGSTATS***. A statistics program for simple field trials for IBM compatible computers. Send disk and return mailer, or check for $5 made out to Oregon State University, addressed to Russ Karow, Crop Science Building 131, OSU, Corvallis, OR 97331.

5. ***Alternative Approaches to On-Farm Research and Technology Exchange, Vol. III***, by Charles Francis, Rhonda Janke, Victoria Mundy and James King, eds. This 174-page compendium presents seven papers from a 1995 symposium on alternative research approaches as well as 14 other papers on the subject. $10. Available from CSAS, **(402) 472-0917**.



6. ***Establishing On-Farm Demonstration and Research Plots*****,** by John L. Havlin, John P. Shroyer and Daniel L. Devlin, Kansas State University Cooperative Extension. This eight-page report suggests guidelines for establishing on-farm demonstration or research plots, recording site characteristics and observations and evaluating results. Less than $1, plus tax and shipping. Order from KSU Department of Ag Communications, **(785) 532-1150** or view on the web at **http://www.oznet.ksu.edu/library/crpsl2/**

7. ***On-Farm Testing: A Grower's Guide***, EB1706. by B. Miller, E. Adams, P. Peterson, and R. Karow, Washington State University Cooperative Extension. A 20-page guide to designing and carrying out on-farm research, including forms for record-keeping. $1. Order from WSU Cooperative Extension Bulletin Office **(509-335-2857)** or view it on the web at **http://pnwsteep.wsu.edu/OFT/oftman.html**

8. ***On-Farm Trials for Farmers Using the Randomized Complete Block Design.*** (EC125), by Phil Rzewnicki. This extension bulletin walks you through design and analysis in farmers' language, with calculations that can be done with a calculator. $2. Contact IANR Communications and Computing Services, **(402) 472-2821**.

9. ***On-Farm Research Guidebook***, by Dan Anderson, Department of Agricultural Economics, University of Illinois. This 23-page handbook explains basic research principles and sets forth easy-to-use guidelines for conducting simple on-farm experiments. Free. Contact Dan Anderson at **(217) 333-1588; aslan@uiuc.edu**

10. ***The Paired Comparison*****:** *A Good Design for Farmer-Managed Trials***,** by Rick Exner andDick Thompson, Practical Farmers of Iowa. This seven-page paper offers specifics about how to conduct a paired-comparison cropping trial, featuring real-life examples and worksheets. Free. Contact Rick Exner, **(515) 294-5486; dnexner@iastate.edu**

11. ***Planning and Conducting On-Farm Agronomic Demonstrations and Research***, by Phil Ryzniecki. An overview of how to site and set up on-farm research or demonstration studies in the field, including a worksheet to track applications. Free. Contact Marvin Hall, **(814) 863-1019.**

12. ***Seeing is Believing: Encouraging Change Through On-farm Demonstrations,*** by the Nutrient and Pest Management (NPM) program, University of Wisconsin-Cooperative Extension and UW-Madison, College of Agricultural and Life Sciences. This 75-page guidebook focuses on creating successful on-farm demonstrations, which provide a wider forum for your research results. Free from NPM, **(608) 265-2660**.

"On Farm" Research Sites:

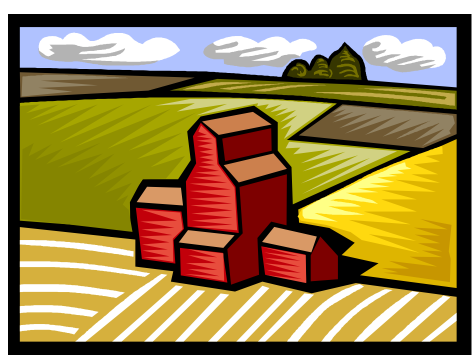
SARE:
http://www.sare.org/onfarm99/

Organic Farming Research Foundation:
http://www.ofrf.org/

Heritage Wheat Project:
http://members.shaw.ca/oldwheat

Alberta Resource:

'Guide to Field Experimentation in Agriculture', Conservation and Development Branch, Alberta Agriculture, 1997. This is a free publication; call (780) 422-4385 on the rite line 310-0000.



SEED RULES – GENERALLY

When seed supply is limited hold back ½ the seed from planting in case the crop fails.

Seed is planted 3x the thickness of the seed generally. Some people plant very deep if soil moisture is deep and dry on the top.

Store seed in a cool dry dark place. Seed vitality leaves when the air is hot, humid and seed is exposed to light.

If you can harvest into paper or cloth sacks to allow the seed to dry out before putting into a jar, that is best. Storing seed in paper bags is fine; watch the bottoms of the bags as they tend to break open.

If you spill seed and can't be 100% sure that it hasn't been contaminated with other seed then put it back into the container. If in doubt, throw it out, as it might contaminate your seed stock.

Label seed at all stages of growing out, saving, drying. Always use two labels; one on the outside of the bag, one inside. Use the Sharpie Black pen. It doesn't fade.

GERMINATION TEST :

You may wish to see how many seeds are 'viable' or able to germinate. Wet a paper towel, take a sample of seed (one per towel) and roll up the towel. Put inside a plastic bag, leaving the end open. LABEL the bag with the variety name! Put in a dark place. In a few days sprouts should be showing on some of the seed. Count the ones that have germinated, and do a percentage of the total seed #. If you get below 85 % you might want to 'grow out' the seed the coming year to ensure a fresh quantity of viable seed.

SHARING SEEDS WITH OTHERS:

- LABEL all containers, envelopes, whatever with:
- Variety name (if not known then give it a name to known by
  for generations onwards: Eg. 'Martha's Red Salad Tomato' (Don't forget to say what kind of a crop it is – red salad tomato, yellow pear tomato) or 'Blais' Red Fife'
- Year seed was grown last (2001, whatever)
- if you wish include your name and locale where seed was grown out

The purpose of swapping seed is to ensure the survival of the variety by its name and lineage.

Our Daily Bread…..
a brief history of wheat

Triticum aestivum, also referred to as *T. aestivum* L., *T. sativum* L. or *T. vulgare*, is simply bread wheat which accounts for 90% of the world's wheat production . Cultivated wheats fall into two distinct classes according to their response to threshing; they are hulled or free-threshing.

Wheats were, and still are the preferred staple food of traditional farming communities throughout the Old world from the Atlantic coast of Europe to the northern parts of the Indian subcontinent and from Scandinavia and Russia to Egypt. It is not surprising that in numerous cultures <u>food</u> has been equated with bread.

Wheat is thought to have originated in the region of the Middle East called the Fertile Crescent and areas rich in diversity of wheat include this region, Ethiopia and the Mediterranean.

These areas are valuable places to look for varieties adapted to low input farming systems. All these regions are at risk with rapid modernization displacing practices and varieties. Tourism is also impacting greatly on ever expanding portions of the globe and it is difficult to farm a crop in regions with political unrest and landmines in the fields.

Canadian wheat breeders have used materials from around the world and continue to go to areas rich in diversity to find new materials for breeding. However, much of the breeding work supports high input high output farming systems and varieties are not suited to low input farming systems.

There are about 200,000 varieties of bread wheat in the world. These varieties have been selected to feed populations, and provide bread or food products adapted to regionally diverse climatic and cultural (including taste!) needs. Varieties developed before the 1930s tend to be adapted to low input farming conditions. There are many varieties growing in areas of the world that support small scale and low input farming systems.

Old Varieties for a New Farming System

There is growing awareness that people are global interconnected through precious resources such as air, water, soil and seed. Also, that low input farming systems are not primitive, but are a way of life that supports not only human life but plant and animal diversity. Conservation of topsoil and seed are imperative or the cycle of regeneration of life is at risk.

Prior to the Green Revolution of the 1960's a great diversity of landraces and traditional varieties were being grown in fields around the world. Many of these have been displaced and perhaps lost in support of high input high yield varieties.

Much of the local traditional knowledge that accompanied old varieties disappeared with the crop. Unfortunately little research attention has been directed towards development and enhancement of varieties that grow well in low input sustainable agriculture systems nor the conservation of traditional ways of growing without high inputs of chemicals and large scale farming practices.

There is concern that old varieties will not yield or perform as well as modern counterparts, but they might well equal or outperform in certain conditions. They deserve to be evaluated with modern sustainable agriculture criteria in today's growing conditions. Varieties that fed populations for decades are not 'inferior' varieties.

Topsoil blows away in the wind and genetically altered crops threaten the genetic resources of the world. We are in serious trouble and need to find more localized regenerative ways of feeding ourselves.

EXPANDING THE GENE POOL OF OUR CANADIAN WHEATS

There are no 'native' varieties of wheat in Canada. The Canadian heritage varieties have come from Europe and Asia; the ancestral species wheats from the Middle East.

Global farming systems and practices are becoming more homogenous; without public awareness and political support traditional practices and crops disappear. In Canada, historic sites like *The Grist Mill at Keremeos* have developed 'living museums' of wheat and heritage gardens. Many sites have nostalgia days when the old farm machinery is brought out for demonstrations. Not only are these practices and varieties of interest historically and culturally, but they may contain answers for marginal land farming, low input farming and crop diversification.

We need a commitment from farmers and the public to immediate soil and seed conservation measures that conserve biodiversity; that support localized agricultural practices, markets and crop varieties. We must find the strength and courage to ban practices and compounds that degrade the quality of soil, seed, water and life.

Government and multinationals are interested in profit. The hand that controls the seed controls the food supply. Let us ensure that hand is of the farmer who is stewarding the land and the seed and ourselves, also stewards of Earth and Seed

Wheat

Spring wheat is planted in the spring and harvested in the fall. Winter wheat is planted in the fall and harvested in the spring. There are no hard and fast rules as to the division line between winter and spring wheat so experimentation is in order.

Old varieties are described in the USDA handbooks dated 1927, 1934 and 1942. The University of Alberta has a complete set of these handbooks, as do other libraries. Agriculture Canada yearbooks describe varieties. Provincial, state and land grant college field note books are valuable to determine what varieties did well in a region.

Variety Identification:

Many of the older varieties have not been grown for decades. There is need to establish a baseline to define a variety by a common name. For example, 'Red Fife' seed was given to a farmer, actually several accessions from different farmers who had grown 'Red Fife', and a sample of 'Early Red Fife'. The farmer mixed all the accessions together. Then he seeded the field, and didn't really clean out the machinery well before he did the seeding. He ended up with sacks

of organically grown 'Red Fife' and only when other farmers grew it out was it confirmed there was a mixture of a soft wheat, as well as 'Red Fife' and 'Early Red Fife'. If we didn't have a baseline pure sample of 'Red Fife' we'd have nothing to compare this mixture to.

So we are calling the mixture 'Blais' Red Fife' but it is a mixture.

We are getting DNA work done on 4 samples of 'Red Fife' to determine a foundation of what we are calling 'Red Fife' today. This work needs to be done with all older varieties if we are to establish credibility for the old varieties in today's marketplace and fields.

Planting to 'grow out seed' to multiply out seed:

Ideally you have optimal soil fertility for the variety you intend to grow out. Sowing is done when the ground has warmed enough (all these are determined by trial and error and the variety you are growing). Many older varieties tiller when they have adequate spacing. Growing out for seed is different than growing out for yield. You may choose to experiment with sowing in separate plots at weekly intervals to measure yield in plots at the end of the season.

The quantity of seed available for planting dictates the size of the plot as well as the type of equipment available for seeding. Hand broadcasting is best done in a plot defined by stakes and string, then raked into the soil. Keep at least 3 feet between plots, ideally more if you have space.

Label the plots; you have a nice display for a Demonstration Plot.

You can harvest three 'one yard square' plots in a big plot to get three measurements of 'yield' within the plot.

Variety Trials:

You will want to lay out plots so each variety is replicated three or four times on the land. When you harvest keep each plot material separated so you can gather the statistics separately. Keep other factors uniform (see basic experimental layout section).

Label the plots; you have a nice display for a Demonstration Plot.

If you are comparing results with other farmers ensure you have used seed from the same seed stock (standardize your seed lot).

Lodging:

When wheat is heavy and high yielding wind may knock it flat. Too much nitrogen produces succulent growth may cause lodging. Lack of potassium, which promotes strong straw quality, causes lodging.

Diseases:

Rusts and blights have been problems with wheat traditionally, but breeding of resistant varieties helps. Smut is a fungus. “Take all" is a name for a fungus disease that is a soil-borne fungus growing in wet conditions on poor soil.

A simple herbal remedy for smut and fungus diseases is horsetail tea, (used for years at The Grist Mill at Keremeos and for a century or more by biodynamic farmers). Pick horsetail (Equisetum sp.)(grows in both wet and dry locations) and put into a pot; add water. Cook about 4 hours. Smells really green and fresh. Add some fresh 'tea' to a spraying device (1/4 cup for a backpack sprayer, but exact measurements aren't important). Spray the plant when it is stressed. Seems to help a plant boost its immunity system as it is high in silica and some unknown anti-fungal agent. You can freeze the cut horsetail but not the tea; use the tea within two days.

Maturity time:

Wheats mature about 80-85 days after planting. To test ripeness, take a kernel of wheat, and bite it. If it is still milky, not ripe. Hard, ready to cut. Different varieties mature at different times. If the seed has tillered, or produced many little shoots with heads from the main stems, then you may want to do a couple of cuts if you are keen to save all the seed. Otherwise if you wait for the side heads to mature the main heads will have overmatured and the seed might be shattering or falling out of the chaff.

Cutting or Harvesting:

Use scissors, or a sickle to cut the plots or rows. You can use old pillow sacks to hold the heads, or paper bags from the grocery store. You MUST label your wheats well as they can look alike. Put one label inside the sack with the plot # and variety name. Put a second label on the outside of the sack; use a black Sharpie to do this as it doesn’t fade.

It is best to let the wheat cure about a week before threshing.

Threshing:

If you are using a machine ensure you meticulously clean out the machine after each variety.

Here’s how to thresh without a machine. Lay one variety of wheat on a large clean cloth on a hard surface. Whack the daylights out of the wheats with a plastic baseball bat. In some parts of the world people lay the grain on the road and let the car run over it then winnow it. The seeds might shatter doing this which defeats the purpose if you wish to save the seed for planting next year.

Winnowing:

If you have a fanning mill to do this job if saves time and ideally cleans the seed up better than hand winnowing. A table-top ‘Clipper’ with an assortment of screens can be purchased at a number of different places, often in auctions and when elevators shut down.

If you don’t have a machine, you can winnow the chaff. Two people can hold a clean cloth (an old sheet?) and toss the grain gently in the air, winnowing off the chaff. Or pour the grain from one container to another in front of a fan or breeze. You might need to do this six or more times. Do the job outside. There will be dust and you might want to wear a filter mask to avoid getting the stuff up your nose. A pair of safety glasses keeps the stuff out of your eyes. Awned wheats with their tiny barbs can lodge in socks, and skin.

Canadian Heritage Wheat Varieties
(with year released, parentage, where developed and remarks)

1. Red Fife, 1885, one plant sent from Scotland from a ship in harbour, from Peterborough, originally from Poland. Good yield, high quality; David Fife obtained sample from Glasgow in 1842.

2. Ladoga, 1888, a land race from Russia. Early, parent of Preston and Stanley.

3. Hard Red Calcutta,1890, a land race from India. Parent of Marquis, never grown commercially in Canada.

4. Stanley, 1895, Ladoga x Red Fife, developed by Ag. Canada, Ottawa. Sib of Preston, never widely grown.

5. Preston, 1895, Ladoga x Red Fife, developed by Ag. Canada, Ottawa. Parent of Garnet

6. Marquis, 1910, Red Fife x Hard Red Calcutta, dev. By Ag. Canada, Ottawa. Wm Saunders cross at Agassiz in 1892. Dr. Charles Saunders selected at Ottawa, using chewing test for quality.

7. Kitchener, 1911. Head selections from Marquis. Ag. Canada. Seager Wheeler made selections, but it was never as good as Marquis.

8. Prelude, 1913, Downey Gehun x Fraser, Ag. Canada. Very early, low yielding.

9. Ruby, 1920, Downy Riga x Red Fife. Ag. Canada. 7-10 days earlier than Marquis, shatters.

10. Garnet, 1925. Preston x Riga. Ag. Canada. Early, matures under cool conditions.

11. Red Bobs 222, 1926. Selected from Early Triumph, which was selected from Australian variety Bobs. University of Alberta. Early, rust susceptible, was grown mainly in Alberta.

12. Reward, 1928. Marquis x Prelude. Ag. Canada. Early, good quality.

13. Early Red Fife, 1932. Marquis x Kanred. University of Alberta. 3 days earlier than Red Fife.

14. Canus, 1935. Marquis x Kanred. University of Alberta. Roto rot and smut resistant.

15. Thatcher, 1935. Marquillo x (marquis x Kanred) Marquillo=Marquis x lumillo (Durum). University of Manitoba. First of series of rust resistant varieties. Widely adapted, good quality. 70% of Canadian wheat acerage in 1953.

16. Rescue, 1946. Apex x S-615 (solid stem type from Portugal via N.A.). C.D.A. Ottawa. Solid stem for sawfly resistance.

17. Saunders, 1947. (Hope x Reward) x Thatcher. Ag. Canada. Released early on basis of extensive testing in Peace River area.

18. Chinook, 1952. S-615 x Thatcher. Ag. Canada. Resistant to sawfly.

19. Selkirk, 1953. (McMurachy x Exchange) x Redman 3. Ag. Canada. Resistant to stem rust 15B.

20. Canthatch, 1959. Kenya Farmer x Thatcher. Ag.Canada. Thatcher type resistant to stem rust races 15B, 11.

21. Cypress, 1962. Rescue x Chinook (Chinook S-615 x Thatcher). Ag. Canada. Sold stem sawfly resistant.

22. Park, 1963. (Mida x Cadet) x Thatcher. Ag. Canada. Early, better seed quality than Saunders.

23. Manitou, 1965. ((Frontana x Thatcher) x (Kenya Farmer x Thatchers) x Red Egyptian x Thatcher). Ag. Canada. More rust resistance.

24. Lemhi 62, 1968. Federation x Cicklon. USDA. Soft white spring.

25. Neepawa, 1969. Similar to Manitou. Ag. Canada. Earlier and higher yielding than Thatcher.

26. Pictic 62, 1969. Yaktana 54 x (Norin 10 x Brever) Mexico. Mexico. First utility wheat licensed in Canada.

27. Glenlea, 1972. Manitou x R1. Ag. Canada. Similar to Manitou in resistance and yield.

28. Napayo, 1972. Manitou x R1. Ag. Canada. Similar to Manitou.

29. Springfield, 1972. Mostly Mexico. Idaho. A soft white strong straw type for irrigated areas.

30. Canuck, 1974. Canthatch x Mida x Cadet x Rescue. Ag. Canada. Replacement for Cypress (sawfly res)

31. Sinton, 1975. Thatcher x Lee x Kenya Farmer. Ag. Canada. Equal to Neepawa in yield.

32. Norquay. (Lerma Rojo x Sonora 64) x Justin. U of Manitoba. Utility type.

33. Chester, 1976. Renown x Rescue x Kendle (Midas x Cadet). Ag. Canada. Short straw.

34. Fielder, 1976. Mostly Mexico. USDA. Soft white spring.

THE WHEAT THAT MADE CANADA "THE GRANARY OF THE WORLD"

David Alexander Fife (1805 - 1877) and the "Red Fife Wheat"

"World Famous "Red Fife" Wheat was developed by David A. Fife, an Otonabee Township farmer in the County of Peterborough. He was a dedicated farmer and concerned about the quality of his crops. David Fife wrote a friend in Glasgow, Scotland, asking him to send some spring wheat. His friend sent him a sample of a new kind of wheat brought into Scotland by ship from Danzig. He planted the few grains in the spring of 1842. The wheat began to grow until one of their cows ate two of the five heads. Mrs. Fife drove the animal away and the remaining three heads matured ten days earlier than the other wheat on the farm. David Fife discovered that the new wheat was more immune to rust, smut and frost damage than any other in this country. Each year as the wheat multiplied, he cared for it, until the spring of 1849, the Otonabee Agricultural Society was able to buy 260 bushels to distribute among its members.

During the early part of this century most of the wheat grown in western Canada was of the "Red Fife" variety. Latterly it has been replaced by earlier maturing varieties, most of which trace their parentage and rust resistant characteristics to the varieties developed by "David Fife".

When a Peterborough district wife chased a cow from her husband's garden. she managed to save three ears of wheat not eaten or otherwise destroyed, The three ears of grain later resulted in the North American continent becoming the leading exporter of wheat throughout the world.

This episode and the amazing later results began in 1842 on the Otonabee Township farm of David Alexander Fife. He was a native of Scotland who liked to experiment to better his crops. Fife wrote to a friend in Glasgow, Scotland, asking him to send samples of wheat so that he might try growing them at his farm in Otonabee Township. The first samples were sown but no crop resulted. Later, the friend scooped a small amount of wheat from a ship landing in the port from Danzig. He sent these samples to David Fife, who planted them in 1841. He roped off a small section of his garden where the wheat was sown. The wheat was growing favorably, however, one day Fife's wife looked out her kitchen window and saw the cow had broken into the section and was eating the grain. She rushed out and chased it to the barnyard. The grain was destroyed with the exception of three stalks of wheat. Fife's wife placed the three ears of wheat in a safe spot inside the house to await planting next year.

However, it was late getting planted because of being temporarily forgotten while she was ill, The regular crop of Siberian wheat had been planted and was starting to sprout from the ground. It was then remembered about the three ears of wheat stored away and this wheat was planted. Although planted late. it grew into grain as soon as the Siberian wheat planted earlier. The new wheat was free from rust disease. whereas the Siberian wheat was badly rusted as was often the case. The new wheat was thus a success. David Fife threshed the precious crop in the palm of his hand and carefully stored it away for planting again.

In time there was a quart of seed and still later a half-bushel. Fife supplied his neighbors with samples. It became known as Red Fife wheat, after its grower and because of its colour. One neighbor later reaped 300 bushels and sold it to the Otonabee Agricultural Society who distributed it to its members. Once Red Fife wheat started to become plentiful, it became the only wheat grown in the area. As the crop yield became greater, it spread across the province of Ontario and into the northern United States. It finally gained favor in Western Canada were for the first time wheat could grown in some of the northern areas where previously it could not be grown because of the short season and early frost. Red Fife wheat yielded a good crop at an early date and was comparatively rust free. Thousands of acres were sown, Towns in western Canada and the northern United States became large modern cities in the wheat-growing belt. Red Fife Wheat was considered a great agricultural find at the time when frost and rust were the two great hazards of wheat producers in North America.

Another Canadian, Dr. Charles E. Sanders, after years of research developed a hybrid wheat through cross breeding Red Fife wheat with an early ripening wheat, know as "Hard Red Calcutta." The cross breeding continued resulting in the development of "Marquis" wheat, early maturing, rust resistant, frost free and a heavy producer. By 1923, Marquis wheat was grown on most of the wheat fields in North America, making the continent a great wheat producer. It is hard to say what the wheat production in North America might be today if it were not for David Fife.

His grave and monument are in Fife's Cemetery near the farm which he pioneered in wheat more than a century ago. It was Red Fife wheat that enabled Canada to earn the proud title of "The Granary of the World" also aided in establishing and expanding many cities and building Canada into a rich and powerful industrial nation.

As a result of the discovery of "David Fife", the prairie grass of our western provinces was replaced with "Red Fife Wheat" and Canada became known as the "Granary of the World"

Taken off the web from:
http://www.nexicom.net/~resson/rfwheat.htm