Q. Re: Genomic selection for wheat

I am wondering what you might have to say in regards to the USDA and CIMMYT's new efforts to develop "climate-resilient" wheat varieties. I have read a little about this project and know they are trying to develop new seed that can produce high yields in warmer and dryer climates by using a process called "genomic selection." Do you know anything about what this process involves? I'd love to hear your thoughts in regards to the argument that these new lab-created varieties are the answer to decreasing global wheat yields in response to warming climates. May 25, 2015

It is well to realize that all wheat breeding aims for suitability for the intended regional climate, without becoming diseased or damaged.

My main disappointment with USDA and CYMMYT breeding, as well as university breeding programs is their goal of serving conventional commodity agriculture, and the refined flour milling and baking industries. These breeding programs appear to be too much separated from organic agricultural methods that would increase soil fertility by appropriate crop rotation and animal pasturing. Instead of refined wheat flour, we desperately need our basic food grains supplied in the whole grain form if we are to combat the obesity and diabetes crises. Breeding for the current refined flour milling and baking industries is a contradiction to these needs.

Also the goals of USDA and CYMMYT in breeding appear to be towards varieties that would be appropriate in several climates, which would put our food supply at risk if such varieties were indeed grown widely and failed. It is also unlikely that such varieties could serve the range of protein and starch characteristics in demand for interesting whole grain products.

The breeding methods currently in use increasingly make use of the new knowledge of the nature and characteristics bestowed by the grouped genes in wheat, which are referred to as the genomes of wheat. New sophisticated lab. techniques are now available for introducing these genes specifically.

Before attempting to increase wheat yield still further than at present, it would be wise to make sure that wheat is properly used as a basic food for people. If wheat were to be presented in the whole grain form, 25% more wheat would be immediately available. This extra 25% is currently fed to animals in the form of bran and germ. If animals were pastured instead of being fed whole wheat grain, yet more wheat would be available for people.

Instead of attempting to isolate the yield potential of wheat, a better plan in my view would be to also grow wheat for its potential as a soil builder grown in rotation with pasturing, vegetables and legumes. In this way the total food supply would be enhanced, rather than wheat yield alone.

The climate is changing rapidly, too quickly for breeders even with

their modern methods. Instead we need to look to the landrace varieties, and possibly some modern varieties already in existence and select those from regions with a climate matching the current local climate. For example, durum wheat is naturally drought tolerant and grows well in southern California. Until now the recommendation has been not to grow durum wheat north of San Francisco, in the Sacramento Valley. However rainfall has decreased drastically and irrigation water is less available so that durum wheat has now become a good choice for Sacramento Valley.

Q. Re: Landrace wheat

In your opinion, why is it important farmers continue to grow landrace varieties? Do you think these varieties, which have clearly been able to survived thousands of years, can persist through possible warmer and drier environmental conditions? May 25, 2015

Landrace wheat, as a result of its long history of success in particular climates, is appropriate for agriculture as practiced before the introduction of herbicidal and pesticidal chemicals and fast release nitrate fertilizers. The best of these ancient methods maintained soil fertility with long-term crop rotation including legumes and brassica vegetables, and animal pasturing.

In general landrace wheat produces taller straw, tillers more, and has larger roots than modern varieties. These properties are valuable for increasing carbon sequestration.

Landrace wheat varieties are non-proprietary, so making it possible for farmers to save seed economically from their crops for one year to the next. Seed companies can service landrace seed and sell to farmers who want to grow landrace wheat but do no more than combine harvest it for sale.

Since 1880 we have suffered from the refinement of wheat flour so that all the varieties introduced since that time have been aimed at refined flour milling and baking. The landrace varieties in existence before 1880 were aimed towards stone milling of wheat flour in the whole grain form as basic food, and the much wider range of culinary characteristics than can be found in *modern* wheat grown after 1880.

Modern breeding produces wheat varieties that are often proprietary and that are not expected to resist disease under conventional agriculture for more than about 5 years; so they need to be frequently replaced. Under this system the millers make adjustments to accommodate changes, so that the baker has come to expect consistency but in only a narrow range of flours. Farmers feel obliged to buy the latest seed either for its proclaimed disease resistance or high yield. Breeders and seed companies produce and market the new varieties constantly and at a high cost. In contrast a given landrace wheat provides much greater consistency and economy for the farmer, miller and baker.

The simple method of selecting a landrace variety, originating in a region with a climate matching the evolved climate locally, is a useful alternative to modern wheat breeding.

In my view therefore we need to continue selecting and growing landrace varieties according to their climatic origin, as an important alternative to breeding wheat.

Since there are landrace wheat varieties available from every microclimate in the Old World, then there are theoretically landrace varieties that will be suited to any changed climate locally. The only exceptions will be in the tropics and polar regions.