

Letters

Genetic Vulnerability

A common misconception is implied in John Walsh's article "Genetic vulnerability down on the farm" (News and Comment, 9 Oct., p. 161). According to this belief, an increase in the size of a germplasm collection will substantially decrease genetic vulnerability for that crop. In most cases, particularly for the major crops, this is not so.

The term genetic vulnerability refers to the risk incurred when large areas are planted with the same crop variety or with varieties having the same genes or cytoplasmic factors. If conditions arise which cause the genes or cytoplasmic factors to be harmful to the variety or varieties in which they are found, production of the crop is affected, sometimes drastically, as in the case of the southern corn leaf blight. However, this vulnerability is the result of genetic uniformity in commercial fields, not in germplasm collections.

The status of wheat, of great importance both nationally and internationally, illustrates this point. A report (1) by the National Academy of Sciences (NAS) on genetic vulnerability shows that in 1969 there were 269 wheat varieties planted on a total of 44 million acres. Over 50 percent of this acreage was planted with just nine varieties. Therefore, genetic uniformity existed even though there were a large number of varieties available.

At the time the NAS report was written, the Department of Agriculture's wheat collection maintained at Beltsville, Maryland, consisted of 19,500 accessions. The collection now contains 36,000 accessions that have been collected from almost every country in the world. This indicates a substantial response to the needs stated in the NAS report. As sources of new genes or outstanding gene combinations become available, they will be valuable additions to the wheat germplasm collection. However, there will be diminishing returns to genetic diversity with future additions to the collection. The 85 percent increase in the collection size after 1972 most likely did not result in so large a percentage increase in diversity in farmers' fields.

It seems paradoxical that Donald N. Duvick's survey, which is mentioned in Walsh's article, showed that breeders feel elite lines have sufficient genetic diversity to provide the pest resistance required. Yet they indicate that germplasm collections, which should have much greater genetic diversity than the elite lines, are not large enough.

Substantial increases in the number of accessions is an easily stated goal, and one that could be achieved, although at a large cost when the evaluation, maintenance, and storage costs are considered. It would be unfortunate if a disproportionate share of germplasm resources are spent on this particular solution to genetic vulnerability at the expense of other, probably more important, factors, many of which the NAS report notes are economic and legislative in nature. The National Plant Germplasm System needs guidelines for regulated, cost-effective growth of germplasm collections.

WAYNE M. PORTER

DAVID H. SMITH, JR.

*Small Grain Collection,
Germplasm Resources Laboratory,
Agricultural Research Service,
U.S. Department of Agriculture,
Beltsville, Maryland 20705*

References

1. Committee on Genetic Vulnerability of Major Crops, *Genetic Vulnerability of Major Crops* (National Academy of Sciences, Washington, D.C., 1972).

Coal Conversion Processes

The recent article by Arthur L. Robinson regarding the American Physical Society's panel on coal technology (Research News, 25 Sept., p. 1484) was read at General Atomic with great interest. The panel's recommendations regarding physical modeling of coal conversion processes are consistent with our own experience over the last 12 years in developing fluidized-bed combustion processes.

In past years, a persistent problem with fluidized-bed coal combustors has been the utilization of fine coal and limestone (a sorbent for sulfur released from coal) that is elutriated from the fluidized bed and cleaned out of the flue gas,

typically using cyclones and fabric filters. Five years ago, a group of physical scientists at General Atomic initiated a combustor modeling effort to determine the optimum method for recycling these powdery fines that contain a significant fraction of coal and limestone. A straightforward physical model was formulated, based in part on earlier work on pure carbon combustion by O. Levenspiel at Oregon State University. It was necessary to work with this model numerically using a digital computer in order to handle the wide variety of conditions that the fine particles encounter as they progress up through the fluidized-bed combustion chamber.

The model was initially applied to a pilot-scale, fluidized-bed graphite combustor, operated by General Atomic for the Department of Energy on a nuclear spent-fuel treatment program. Operating the combustor at the optimized recycling conditions determined by the model resulted in combustion efficiencies greater than 99.9 percent. This model was subsequently used by the Electric Power Research Institute (EPRI) to help determine the required fines recycling conditions for the Tennessee Valley Authority's 20-megawatt (electric) fluidized-bed coal combustor pilot plant. Recent coal combustion tests at General Atomic have shown that, in addition to increasing combustion efficiency, a 60 percent reduction in limestone addition may be realized by using high rates of fines recycling. We are now correlating these results for EPRI with a modified version of the model that is specific to sulfur capture by limestone.

Our subsidiary Pyropower Corporation has taken advantage of the greatly improved performance and economics that fines recycling has to offer and is actively marketing circulating-bed combustors in North America for a wide variety of solid fuels, including high- and low-rank coals, petroleum coke, peat, and wood waste. Using advanced European technology, augmented by the modeling techniques mentioned above, they are able to offer coal combustors meeting the most stringent U.S. emissions standards while attaining very high combustion efficiencies and low limestone sorbent requirements. This technology has been proved on industrial-scale coal boilers of up to 65 megawatts (thermal).

Because of our very positive experiences using computer-based physical models of fluidized-bed coal combustors, we strongly support the American Physical Society's recommendations for further work toward improved instrumenta-