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ECONOMIC DEVELOPMENT VIA NEW CROPS/PRODUCTS FROM AGRICULTURE

**Report of Seminar
College of Agriculture
and Extension Division
University of Missouri-Columbia
November 15-16, 1990**

**Special Report 422
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ECONOMIC DEVELOPMENT VIA NEW CROPS/PRODUCTS FROM AGRICULTURE

The 18th in a series of seminars on agricultural marketing and policy, held on the University of Missouri-Columbia campus November 15-16, 1990, featured the developmental potential for new crops or products from agriculture, including products that may be newly produced from traditional crops. A theme that ran through the seminar noted the benefits to be gained from diversification. Those benefits would accrue to both farmers and rural businesses.

Included in this proceedings report is the Ruby and Mary Green Lecture given by Dr. Remington.

The seminar series began in 1973. Now called the Breimyer Seminar, it is funded from the University of Missouri-Columbia Development Fund. Contributions are appreciated. They may be sent to the Development Fund office, 117 Alumni Center, Columbia, MO 65211.

Melvin G. Blase
Chairman, Seminar Committee

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NEW CROPS/PRODUCTS FROM AGRICULTURE:
SETTING THE STAGE

Hon. Cooper Evans
Agriculture Advisor to
President Bush

I am delighted for the opportunity to set the stage for the discussions at this seminar. I interpret my role as allowing me to give an historical perspective, which is what I intend to do.

I begin from a conviction about the importance of diversification in U.S. agriculture, including the economic impact it will have. I am thinking in terms of some interval of time. It won't happen tomorrow, but over a number of years.

I also feel sure the timing is right for addressing the subject of this seminar. There is now a widespread interest in diversifying into new crops, new products. But more important in my mind is that I believe we have made truly significant progress in government the last year or two in recognizing the importance of developing new products and of diversifying our agriculture.

How did we arrive at this kind of interest? Of course the idea of diversification has been around a long time. Much of the favorable attitude toward it is explained by the history of the evolution of the soybean crop, which took something like five decades. The soybean has accounted for a major change in U.S. agriculture and with its 60 million acres is now a major crop of our time.

One of the things the soybean experience did was to fix firmly in the minds of most farmers and agriculturalists the belief that new crops can be important, given the right circumstances. It is fair to say that for a long time farmers have been hoping for another "soybean miracle."

As to serious ideas about what a new crop can offer, to the best of my knowledge the first outstanding action was the establishing, during the Eisenhower Administration, of a task group on New and Special Crops. It looked into what the possibilities might be. Predictably, the findings of that group in 1957 are about what they would be today. It said there were real possibilities and something ought to be done about them. Nothing much was done, and it is interesting to speculate on what kind of agriculture we would have today if work had got underway -- if a few million dollars a year had been put into serious work on commercialization of new crops and diversifying our agriculture.

In reality, it took the rather desperate years of the 1980s, which probably were the worst years for agriculture since the 1930s, to bring home the need for a new and different approach to

U.S. agriculture. We had surpluses of all the traditional crops except during droughts; we had decreasing exports, particularly of the bulk commodities; we had falling land prices; and we know that we lost many of our aggressive young farmers.

This experience forced some new thinking. Farmers and academics and policy people all came together to examine agricultural policies and search for new options that might improve the situation. There was general agreement on a number of the obvious realities. We knew we had excess capacity for the established markets, and that we were too dependent on too few crops. No one was completely sure what to do but there was recognition that we had to look for a better tack. It was also recognized that it was not politically feasible to continue an agricultural policy where federal commodity programs accounted for half the net farm income. In other words, it was obvious that it was politically not feasible to continue a situation where federal payments to farmers equalled or exceeded the amount of money earned by farmers from markets. That is the situation we were in for several years.

The 1985 farm bill began to address some of these problems. However, it did not do much on diversification or commercialization. It addressed some of the export issues, some of the environmental issues, and certainly the issue of the height of federal price support payments. It set a new course, the gradual lowering of price supports on major crops that continues to this day. It was apparent even then, though, that if this course were carried to its logical conclusion the result would be a lean, highly efficient agriculture in this country that could compete effectively but would be much smaller in terms of the number of farmers and of the acreage that would be involved in their agriculture.

These discussions during the troubled 1980s focused on doing something different in our agricultural policies and in the mix of crops we raise. But the most important insights came from an assessment of our markets and our marketing strategy. Clearly, when one looked at the domestic markets for food and feed, they were essentially saturated. They would grow only with population. There were exceptions, of course. Minor and specialty crops offered some promise, as did feed to the extent we could expand our export markets for meat, poultry, and farm-raised fish, and of course new products from the old crops, ethanol being the principal example.

With respect to the export markets, it was apparent that truly dramatic changes were taking place in world trade. We had long dominated trade in the bulk commodities. What was disconcerting was that the mix of world trade was changing dramatically. By the 1980s bulk commodities accounted for only about 20 percent of world trade in agricultural and food products. And this part of trade was not growing. The remaining 80 percent of that trade consisted of higher value products, extending all the way from soybean meal to soybean oil, meats and poultry, vegetables and fruit; and to the

processed goods, even snack foods. This part of the trade was growing fast and still is, at something like three percent a year. The discouraging point for us is that we had a very small sector of that market, 7 to 10 percent, as opposed to the Europeans' 50 percent. Our people had never taken a great deal of interest in that side of world trade.

When we looked at our major export markets, we saw our buyers were the major industrialized nations. The major opportunities for us lay in the higher value products. The problem with them was that in many instances the buying countries had erected trade barriers to limit imports of those products.

But there were some fascinating possibilities. One example is fruits and vegetables. Fruits and vegetables have been the most rapidly growing U.S. agricultural export in several of the recent years. They are number one in our agricultural exports to several of the major markets -- Canada, Hong Kong, Singapore. They are high, in dollar value, on the list of exports to Japan. The less developed countries, agricultural economists tell us, offer the best opportunity for bulk commodity exports. I believe that is true. The principal problem, as we know, is that they don't have any money. They can't pay for the products. Therefore, the prospect for growth in exports to those countries depends on the assistance we give them through our aid program.

The obvious general conclusion is that exports of bulk commodities for traditional uses will not be the salvation of U.S. agriculture no matter how hard we try. We have to extend our horizon. We have to use imagination. We have to examine new concepts. We have to explore all the possibilities; and above all we have to be flexible in our thinking.

Among the options that need to be explored two are important and relevant to this seminar. One relates to processed products from existing crops, particularly new and non-food products, together with supplying raw materials for industrial use. Second, of course, are the new crops. If it is not possible to find another soybean miracle, let's try to find a miniature soybean miracle.

In 1984 John Block as Secretary of Agriculture convened a challenge forum to make an "exploration of new directions for agricultural products and markets." "As an industry," he said, "we are rethinking our destination and rethinking the paths we need to take to get there. Certainly there are some new routes we need to explore and I want you to tell me what they are."

The forum took a hard look. It strongly recommended an in-depth analysis of the possibilities for new crops and industrial products; and this led, the following year (1985), to the formation of a new task force. This was a collaborative effort among industry, academia, and government. It was chaired by Dr. Ronald

Sampson of Procter and Gamble, a highly qualified and experienced advocate for new crops and new uses, particularly industrial uses.

The goal of that task force was to find and to propose meaningful do-able missions based on comprehensive analysis. The task force worked two years and it made a comprehensive analysis. It came back in 1987 with what I regard as a thoughtful, meaningful assessment. The task force confirmed the intuitive judgments we had formed. Our agriculture had fundamental problems, with an over-concentration of production in a few major food and feed crops. World-wide production of these crops was increasing but world trade in the bulk commodities of these crops was more likely to shrink than to grow, the task force said. It also said that U.S. agriculture on the farm, in Washington, and in universities was not adjusting rapidly enough.

The task force made more specific recommendations. It concluded that we had 150 million acres of surplus capacity, and that diversification in both crops and products should become a national priority. It urged that the goal within that priority should be to develop within 25 years an array of new farm and forest products to meet market needs and to utilize the 150 million acres. The task force noted that this was equivalent to developing two and one-half to three soybean crops within half the time that was required for the soybean to evolve into an important crop.

The group estimated that if this could be done it would create 750,000 jobs in this country, it would add \$30 billion to farm income, and it would contribute \$100 billion to the national economy. As net farm income averages \$40 to \$50 billion, \$30 billion would be a highly important step forward.

The task force also had a lot to say about strategy, about how we get from here to there. It is essential, it explained, that we reallocate substantial public and private sector resources including funds for the development of new farm and forest products; also to establish new mechanisms for public-private sector collaboration. A need was seen for a new mechanism for transfer of agricultural technology from public research to the industrial sector. But most important of all, the task force concluded that we had to have organized programs specifically charged with identifying the best opportunities, encouraging the development of new farm and forest products, and boosting their value through commercialization.

In agriculture we have an excellent record of putting to work the innovations that come out of research -- applying them to production agriculture. We do that quickly, particularly when those new techniques reduce cost or improve efficiency of production. We have a dismal record, however, of transferring to practical use the products of research and development when they deal with such matters as industrial application of farm crops.

So the task force concluded that an independent organization should be charged with this mission. Within that organization there had to be competency, not only in R&D but also in finance, engineering, and marketing. The principal purpose would be to focus resources upon the most promising possibilities in the R&D cycle. Its independence also was essential so that the new organization would not feel compelled to defend any existing institutions and programs.

To accomplish this goal and to implement this strategy the task force urged the establishment of a Foundation for New Farm and Forest Products. It would be financed from a trust fund of one billion dollars, a substantial sum of money. It would come from the Commodity Credit Corporation over a period of several years, derived from sale of surplus commodities. All of it would be invested in Treasury securities that would yield \$75 million a year in interest, to be used for seed and venture capital and the like -- none of it to go into in-house research and very little into administrative costs. The thought was that over the years this would generate substantial royalties and that eventually the trust fund would revert to the Treasury.

The task force again emphasized the importance of a multi-disciplinary management and staff. It recommended that the Foundation be governed by a board of directors appointed by the Secretary of Agriculture, and would report to him but would have great independence in setting goals and conducting operations within the policy established by the President and the Congress.

The task force recognized that the Foundation would need flexibility for cooperative action in the public and private sector in making grants and loans and entering into joint ventures; and that it would have to be able to make a profit and to acquire proprietary interests. It was truly a revolutionary concept.

The task force noted that if farmers are to be encouraged to grow new and experimental crops, the farm program had to have sufficient flexibility to permit planting of those crops. Flexibility has been talked about in the past year and some is incorporated in the new farm law.

The task force made the point that there has to be a shift in emphasis in USDA research and development. It is a natural tendency to put most R&D money into the major sectors of our agriculture -- corn, cotton, wheat, soybeans, cattle, hogs, whatever. These sectors have constituencies. Heavy research emphasis on them is not necessarily, in the long term, the best investment for R&D funds.

The task force called biotechnology important but also pointed out its limitations. One limitation arises from the natural tendency for biotech efforts to go almost entirely into increasing the efficiency and the output of existing crops. Some of the R&D

money, the task force felt, might be better spent on new and different crops and uses.

The task force also noted the long odds that go with new-product development. Of new products that are examined, perhaps not more than two in 100 will actually prove to be a viable commercial opportunity. Even those would require a relatively long development time. The task force also mentioned the fact that although it had given most of its attention to new crops and new uses of existing crops, it had done enough work on animal products to urge strongly that they be given considerable attention. Many new products from animal production could have important industrial uses.

All this took place in 1987, not long ago. How has the concept fared since the task force submitted its report? There is good news and bad but more of the good than the bad. On the bad news side, it comes as no surprise that the Office of Management and Budget, given its oversight role on the budget and preoccupation with reduction of the deficit, gave the task force report a very cool reception. In fact, it opposed the report's recommendations. It is only fair to say that some parts of the USDA had some reluctance to go the task force route. The concept presented a threat to some of the established interests, which did not want to reallocate research money. Also, the Department saw the idea of an independent agency as representing some loss of control.

That was the bad news. It was overwhelmed by the good news that President George Bush is a very strong believer in diversification of American agriculture and in the concept of industrialization. Secretary Yeutter, Deputy Secretary Parnell, and Assistant Secretary Hess all recognize that this is an important area and has to have more emphasis. But I think the most remarkable success was with the Congress, which received the concept very favorably. By the fall of 1988 both Houses of Congress had passed legislation that would do something on the order of what had been set forth in the task force report. Unfortunately, the two bills were enacted too late for reconciling their provisions before Congress adjourned. So the legislation died. But it was obvious that the next Congress would do something; and that Congress did act. In terms of progress, it's important to point out also that federal funding for agricultural R&D is being increased very substantially. No large part is going into new product work but I think the prospects for more funding are good.

I repeat in closing that I believe strongly in the subject of this seminar. Just so you know I am serious about this, I report that in addition to raising, on my Iowa farm, corn and soybeans and walnuts, I also have a farm in northern Missouri and that in the spring of 1990 we made plantings of 17 different species of horticultural crops -- 50 different varieties of these crops -- just to see what would grow well there. So I am genuinely interested in the explorations that are the topic of this seminar and I am pleased for the opportunity to participate in it.

NEW CROPS/NEW PRODUCTS: PROVISIONS IN THE
1990 FARM BILL

Mervin Yetley
Staff Economist
U.S. House Committee on Agriculture

A couple of items in the 1990 farm bill are particularly relevant to the topic of this seminar. By way of background, the farm bill has 22 titles. When we of the staff picked up the text comprising the bill (the conference report) and took it to the clerk of the House of Representatives, the stack of paper measured 14 inches and weighed 10.3 pounds.

Enacting the law was a huge undertaking. I am glad I was a part of it but I am not sure I want to live through such an experience a second time.

One major objective of the law grew out of a concerted desire on the part of both the Senate and House to provide greater flexibility to producers. The intent was to give producers the opportunity -- and encouragement too -- to produce for the market and not for government programs.

The second idea or objective that surfaced repeatedly was to retain or regain the former U.S. share of the international oilseed market. This gave rise to oilseed producer provisions that also I will point out in general terms.

Unfortunately, I cannot provide specific or detailed information on various features of the law including those relating to oilseeds. The Department of Agriculture is buried up to its ears in developing rules and regulations to implement the new law. I cannot second-guess just what those rules may prove to be.

The flexibility aspect of the farm bill was addressed primarily through the triple base feature. The term itself is misleading. Essentially, programs begin with the acreage reduction or set-aside that has been a part of commodity (crop) programs for many years. The next feature brings in flexibility (or triple base). For each of the next five years, 15 percent of the program-crop base (less acreage reduction) is "mandatory non-payment acres." On this acreage farmers can plant any crop except fruits and vegetables. The law specifies what constitutes fruits and vegetables under this restriction; some of the items are not what we think of as fruits and vegetables in our gardens.

Except for the prohibited fruits and vegetables, a farmer can plant any crop on the flexible acreage without losing his base for the program crop. Thus, presumably, each farmer has more acreage than before that he can utilize as he sees fit.

The law, like all legislation, was something of a compromise between the administration's early proposal, which called for substantially more flexibility than was later enacted into law, and the preferences of Congress. The eventual outcome was the 15 percent flexibility figure. Let me make clear that the 15 percent is not that percentage of the program crop base, but of that base minus each year's acreage reduction. This is an important difference, particularly for a wheat grower who faces a 15 percent acreage reduction this year.

One side effect of the 15 percent flexible acres is to change the terms of the 0-92 program option. Zero-92 does not exist any longer. It's more like 0-78. It's that because the 15 percent flexibility is factored out of the 92 percent. Take 15 percent of 92 and subtract the figure from 92, and you will get approximately 78.

Perhaps it is gratuitous, although not totally so, that these flexibility ideas were introduced into legislation just at the time when we were needing more flexibility in agriculture and ways to make use of it. Let me repeat some of the background Mr. Evans set forth. Traditionally, in the United States and other countries as well, agriculture has been devoted to producing primarily food, feed, and fiber. With the new flexibility we can also turn out commercial products -- new products, products that go directly into the commercial chain and skip the food, feed, and fiber stages. That is not to say, however, that crops now grown for food, feed, and fiber cannot go into industrial uses. So the interest in commercialization as reported by Mr. Evans was taken to heart by both legislative bodies on Capitol Hill and resulted in significant new legislation.

Now a note on the Clean Air Act. This, of course, does not come under the aegis of agriculture committees. The Act is so critical to the idea of flexibility -- growing new crops and producing new products from farm crops -- that it is useful to summarize it at this seminar. The Clean Air Act of 1990 calls for reformulated gasoline and oxygenated fuels, with the object of reducing air pollution. Additional features of the law have to do with small producers of ethanol, excise tax exemption for gasohol, and blender tax exemption. When I called the Energy Department for detailed information I was told that the particular rules have not been worked out yet.

Incidentally, the Clean Air Act mandates that certain metropolitan areas move to oxygenated, low-polluting fuels. Producers of those fuels can expect to see some impact in the relatively near future.

A development also of interest to this seminar is the funding of biomass research and development. A substantial amount of money will be available under appropriations for the Clean Air Act to conduct research on biomass. The law is pretty hard on utilities

such as those that use high sulfur coal. Geothermal and solar energy also are addressed, as investment tax credits are extended.

Within the 1990 farm bill, several provisions relate directly to flexibility in producing new crops and new products. All of them anticipate and revolve around the potential offered by subtitle G of the research title which provides the AARCC that Mr. Evans reviewed. The whole object is to provide new outlets for agricultural commodities, be they crops currently produced or new crops. An example of a new crop is canola. Rapeseed has been around a long time but canola is new to most people in agriculture.

The function of this subtitle is to make grants and enter into cooperative research agreements. How does one take a product that is currently grown, or a new product that holds potential, and move it into the commercialization process? That doesn't "just happen." Certain actions must be taken to bring that about. A number of persons here at the University of Missouri are leaders in that field. Also provided for in the act are loans and interest subsidies and under certain conditions equity can be put into ventures designed to commercialize new products. The Center is expected to collect and disseminate information and to lead the search for new non-food, non-feed possibilities. Congress has a substantial interest in this concept. Nor will that interest fade; it is not here-today, gone-tomorrow. It has strong bipartisan support.

This does not mean that AARCC yet has the money to do all that the law authorizes. It will be tough to get appropriations to make it fly, particularly under current budget restrictions.

AARCC, in fact, has no money behind it just now because appropriations legislation was completed a few days before enactment of the farm bill, so no line item appeared in the appropriations. Congressmen will want to provide funds in later appropriations action but no money is at hand now.

The AARCC will be headed by a director chosen by its board and approved by the Secretary of Agriculture. The Center will be entirely independent of other research organizations within the USDA and will report directly to the Secretary. Congress wanted to make clear that it was serious about the AARCC assignment. It made AARCC a special entity that Congress will be able to monitor closely, and that has no other incumbency to be concerned about. "This is your job; you do it," Congress said.

The AARCC's governing board will provide general supervisory control, review contracts, and determine where regional centers will be. Two regional centers are authorized, as a minimum, and others could be added. Membership is probably the key point. One member of the board will be a staff person of USDA, perhaps an Assistant Secretary or Deputy Under Secretary. Of four other members, at least one will be a leading scientist; at least one a producer or processor of agricultural commodities; and at least one

privately engaged in commercialization of new non-food, non-feed products.

Two members will have expertise in relevant areas of applied research and these will be picked from among at least four persons nominated by the National Science Foundation.

In similar boards or organizations of the past, Congress has usually given the Secretary of Agriculture the privilege of choosing the members. In this case, Congress has said that this is a new area where the Department of Agriculture does not have a particularly strong track record, so let's go outside of our old-boy network and see if we can bring in some fresh blood and some fresh ideas.

Two other members of the AARCC board will have financial and management expertise and will be chosen from four nominees suggested by the Secretary of Commerce. Perhaps one will be from the Small Business Administration. Again, the object is to draw on a new source of ideas and competency.

I hope my review convinces that the elected members of Congress, both the House and the Senate, have seen the need for agriculture to have more flexibility to produce for the market and one of the markets Congress hopes farmers can produce for in the near future is new products that can move directly into the commercial channel.

The Breimyer Lecture

THE RESEARCH CHALLENGE OF NEW CROPS/PRODUCTS: THE UTILIZATION DIMENSION

W. H. Tallent
Assistant Administrator
Agricultural Research Service
U.S. Department of Agriculture

It is appropriate to discuss my assigned subject at this time. This year (1990) is the 50th anniversary of the establishment of the four original regional research centers (RRCs) of the Agricultural Research Service (ARS), or utilization laboratories as they once were called. All four opened their doors in 1940. Among other activities to commemorate the 50th anniversary, all four had open houses this past summer.

The 1938 legislation authorizing the four laboratories called for them "...to conduct researches into, and to develop new scientific, chemical, and technical uses, and new and extended markets and outlets for farm commodities and products, and the byproducts thereof." The laboratories soon had many notable successes. Work at the Northern Laboratory in Peoria, Illinois, hereafter referred to as the Northern Regional Research Center (NRRC), led to commercial production of penicillin and provided the basis for the entire antibiotics industry. Research at NRRC also made major contributions to the corn sweetener industry.

Similarly, work at the precursor of the Southern Regional Research Center (SRRC) at New Orleans led to technology (e.g., permanent press cotton garments) that saved the cotton textile industry from destruction by competition from synthetics. Research at what later was renamed the Western Regional Research Center (WRRC) at Albany, California, provided the scientific basis for the frozen foods industry. Epoxidized oils developed at the Eastern Lab, later called the Eastern Regional Research Center (ERRC), in Philadelphia are essential plasticizer-stabilizers in all vinyl plastics. Without them or any equally effective substitute the vinyl plastics industry could not exist.

In the later 1970s the view that the kind of research done at the RRCs ought more appropriately be conducted in industrial laboratories came to prevail in influential circles. As a consequence, the centers were forced, under severe budgetary pressures, to redirect their programs largely into other areas. For a variety of reasons the pendulum has swung back, and publicly funded utilization research has again become fashionable. Accordingly, ARS is redirecting much of the research at the RRCs back to their original mission.

The challenge for agricultural utilization research is twofold: to develop products and processes to compete with those from petrochemicals and imports, and to have significant positive impact on the agricultural economy.

To compete with cheap competitors (petrochemicals and imports), we need to exploit the unique properties nature puts into agricultural materials. Products from starch and other carbohydrates provide striking examples. Super Slurper is a starch-derived water-scavenging agent that enjoys many applications ranging from throw-away diapers to use in fuel dewatering filters. The chemical reactivity of starch makes possible its use as a matrix in sustained release pesticide formulations. Research has shown that other properties make it possible to use starch in place of carbon blacks in tires and other rubber articles. The fact that microorganisms readily attack starch is the basis for its use in biodegradable plastics. Unique functional products of other carbohydrates are the basis of the usefulness of "fluffy cellulose," a non-caloric high-fiber ingredient for bakery products, and "Oatrim," a product made from oats that has a creamy soft margarine-like texture and can be used as a fat substitute.

A very important property of carbohydrates that can be exploited to economic advantage is their amenability to bioprocessing, including fermentation. Ethanol production is the classic example of this. Ethanol is receiving renewed attention as a gasoline additive, as is its derivative, ethyl t - butyl ether (ETBE). Efforts are currently underway to incorporate into one microorganism, by means of genetic engineering techniques, the ability to ferment cellulose and hemicellulose as well as starch. Success in this endeavor will increase the yield of ethanol from corn from 2.5 to 3.5 gallons per bushel. Other potentially valuable products attainable through fermentation from carbohydrates include hydroxy butyric acid and acetic acid. The former can be polymerized to provide another type of biodegradable plastic. Acetic acid is the main ingredient in CMA (calcium magnesium acetate), a "green" substitute for salt as a de-icing agent. Of course, acetic acid can be made from petrochemicals, but making it from carbohydrates has the advantage of starting with a renewable resource.

Like carbohydrates, other natural products are bioprocessable. Hence, the possibility exists of converting soybean oil to a product that can replace imported castor oil, which is an important raw material for lubricants and plastic additives and even a medicinal agent. New uses of soybean oil and other fats and oils largely derive from their unique chemical and physical properties imparted by the presence in their molecules of long hydrocarbon chains terminated by what chemists call functional groups. Reactive sites -- notably sites of unsaturation -- often also occur along the hydrocarbon chains. Fats and oils are the most prominent subset of a broader family of natural products called lipids. These are roughly defined as materials soluble in solvents that are non-miscible with water.

In addition to the already mentioned epoxidized oils, early research on fats and oils led to polyamides that are the curing agents for the familiar two-part epoxy glues. More recent research at NRRC has led to a patented soybean-oil-based printing ink for newspapers. An interesting combination of a carbohydrate and components of fats and oils is a family of products called sucrose esters. Early versions of these developed at SRRC are used as edible food coatings. More recently, Proctor and Gamble scientists achieved a higher level of esterification to produce sucrose polyesters, which the Company hopes to market as the fat substitute Olestra.

Even nylons can be made from fats and oils. For example, nylon 9 can be made from soybean oil and nylon 1313 from crambe oil or high-erucic rapeseed oil. Mention of crambe leads to the subject of new crops. These afford an excellent opportunity to exploit the tremendous versatility of nature. From the early 1960s to the late 1970s scientists at NRRC conducted a screening program that led to discovery of more than 100 new lipids in seeds of uncultivated plants. Further chemical research on these new lipids provided the basis for selecting several of the plants as potential new crops. Crambe's prominence is based on the presence in its seed of an exceptionally long-chain fatty acid called erucic acid. Cuphea oil, on the other hand, is of interest because it contains exceptionally short-chain fatty acids, making it a potential replacement for imported coconut and palm kernel oil. Lesquerella oil is very similar to castor oil. Vernonia oil is a natural exoxy oil. Limnanthes (meadowfoam) oil contains exceptionally long-chain fatty acids with unusual unsaturation sites. Other potential new crops produce highly unsaturated and reactive oils that could replace imported tung oils.

Commercialization of these new crops presents the doubly difficult challenge that production capacity and processing demand need to be developed in concert. Other problems pertaining to commercialization of new products, in general, are discussed below.

Examples of exploitation of nature's chemical versatility can also be cited for a third class of natural products, namely proteins.

Particularly interesting is Simplese, a new fat substitute marketed by the Nutri-Sweet Company. Thus we have fat substitutes from carbohydrates (Oatrim), proteins (Simplese), and a carbohydrate-lipid combination (Olestra). Proteins can also be spun into fibers. Some years ago an abortive attempt was made to market textiles made from the corn protein zein. Likewise, textiles can be made from the milk protein casein, and scientists at ERRC have recently developed edible coatings for fruits and vegetables from casein.

These may be enough examples to make the point that the possibilities for new products from agriculture are limited only by scientists' imagination. Getting them to the market is something

else again. To begin with, the issue of market-pull vs. technology-push needs to be touched upon. It is always better if researchers can respond to a clearly identified market demand. However, it is important to observe that technology-push also can work sometimes. Notable examples are lasers and Super Slurper. Both were developed by scientists to answer "what if" questions without knowing what the potential uses would be.

The process of moving new technology from the laboratory to the commercial processing plant is called technology transfer. Three common barriers to technology transfer are cultural differences between researchers and processors, the NIH (National Institute of Health) syndrome, a syndrome not invented here; and the R&D gap -- i.e., the separation between the stage to which Government or university researchers generally bring a new technology, and that at which processors are willing to pick it up. By authorizing mechanisms for getting Government and industrial scientists and engineers to work directly together, the Federal Technology Transfer Act of 1986 (PL 99-502) provides tools for overcoming all three of these barriers. Overcoming other kinds of barriers pertaining to economics and risk aversion are not within the purview of ARS. In an effort to address these barriers, writers of the 1990 farm bill authorized an Alternative Agricultural Research and Commercialization Center.

The second challenge for agricultural utilization research I mentioned above was to generate a significant positive impact on the agricultural economy. Basically this comes down to helping farmers and rural communities, which first and foremost means creating more demand for agricultural commodities. To do this, we need to realize that only in exceptional cases (ethanol and maybe CMA) can we hope to compete with petrochemicals for bulk chemical markets. On the other hand, very high priced products (e.g., pharmaceuticals) don't use significant quantities of raw materials. This leaves intermediate priced products, an area where we can compete, particularly if we properly exploit the unique properties of natural products.

These new products can create new business opportunities in rural areas. Thus Super Slurper is manufactured in Smeltersville, Idaho, and Lumberton, North Carolina, and is used by a small company in Bement, Illinois, to manufacture fuel dewatering filters. Fluffy cellulose is manufactured in Cambridge, Minnesota, and Mt. Pulaski, Illinois. Indications are the soybean-oil-based printing ink will be manufactured in Iowa. Numerous other examples could be cited. The bottom line is that the best thing we can do for rural development is to provide new products and technologies for new businesses and jobs.

AN AGRIBUSINESS PERSPECTIVE OF NEW CROPS/PRODUCTS

James Atwood
Vice President
Farmland Industries

My assignment could be expressed in terms of an axiom, "New products are tough to start." I can best respond in terms of the difficulties surrounding new products. However, I do not want my presentation to come out negative, because change is what it is all about.

We as an innovative society talk about wanting change but culturally we are not that whipped up about it. We would prefer that things stay a little more nearly constant.

When an organization such as Farmland anticipates new products or any new development the first question we ask is, "Why might we want to change?" What is the driving force that causes us to seek a position different from the one we are in? It's partly a matter of the starting point.

Any person or firm that is in trouble is likely to want something new and different. But one that is already comfortable may not have much driving force. The difference between starting points gives rise to some of the factors Dr. Tallent discusses. The "non-event year" he refers to reflects resistance to change.

The first step to be taken in an organization such as Farmland is to decide what we want to do, where we are (not always easy to say), and where we want to get to. The matter of the desired destination presents its own challenge. Farmland may be said to be in a state of permanent change. We put it that we are in permanent white water.

Ours is a management style that prefers to instigate change rather than only react to it. It sounds exciting; anyone who has done a lot of rafting knows that white water can be fun. But in rafting the trick is staying in the boat, not getting wet, and concentrating on going down stream. All these are possible but in white water one must concentrate and not have attention diverted by other happenings. The situation in Farmland is like that.

In the Farmland system we accept the white water of change, and one of our changes created the department that I head. It is called Emerging Technologies. The unit has several responsibilities, including purchasing and engineering, but emerging technologies represents our major assignment.

I am asked from time to time what an emerging technology is. Is it biotechnology? I answer, "Yes." Is it the far-out new kinds of sciences? "No," I say, "it is simpler than that." What we are talking about in emerging technology is anything we are not now

doing. It is something that meets the strategic plan as to where we would like to go, as analyzed in terms of where we have been.

When we analyze the Farmland system -- a system of agricultural producers, the local cooperatives they own, and the regional associations that the local cooperatives own -- and we see the cyclical nature of agriculture, we know that if we are on only one side of the business it will be hard to avoid economic cycles. When we stay in commodities we go from boom to bust. When we look at the macro picture we see that consumer spending for food goes up pretty much at the rate of inflation, but the dollar value at the farm gate continues to decline. If the Farmland system is to do something about the dilemma faced by its constituents, we need to find some way to add value to the products on the outswing of the farm gate. That concern led us to look into emerging technologies.

Historically, Farmland's major business had been in farm inputs -- 75 percent of the business long was petroleum and fertilizer. Nearly all the capital was in that side of the business. Only a small part was in the food or pork-processing part. When we decided to look at the other end of the business we investigated areas such as those Dr. Tallent speaks about. We looked at starch, fish (aquaculture), any commodity or project that could add value to the products that that farmer supplies and eventually goes into the consumers market basket.

Having changed our sights, what do we do next? We look at value-added items that come off the farm and set out to evolve away from strictly commodity activities.

When looking at new businesses, the first focus must be the market. When a firm enters a new business area it picks its competitors. Not always is a crowd friendly. When a firm encounters its competitors, it finds that they do not want it around. They really would rather not have the new entrant, because that entrant usually enters with a nuance, whether it be technological, market-driven, or raw-material-based. The newcomer has something to offer by which it hopes to establish itself in a niche in the market.

Every firm tries to find a niche market. When it finds one -- well, how do you answer this question? It is sometimes asked me. I come in with a new product and say it will find a niche market, and I am asked, "Why is that a niche?" I explain all the technical reasons why it is a niche but I have not been able to answer this next inquiry: "If that is such a real niche, then how come you were able to find it?" From time to time a person may develop what he thinks is a niche, yet it may not really be one. It is always difficult to do one's homework well enough to make certain that a new entry into a market really has been developed.

In an agribusiness company such as ours, one of the things one looks for is the possibility of entering a business that not everyone can enter. We are in white water, but we also operate a juggernaut. Farmland has a lot of superstructure and the only way

it can be efficient and competitive is to be in those businesses where its size relative to the market dimension can let it be ultimately competitive. We find that the smaller businesses may not necessarily fill our bill. So in our analysis we have to look at those businesses that seem to fit the market segment for farm products that we can enter.

This is one of the reasons we in Farmland are highly interested in ETBE. Ever since the early 1930s we have been a petroleum refiner. We have added input gasoline and diesel fuels so as to make farmers competitive in their energy inputs. It now looks as though ETBE might be something for us to look into.

Another area of exciting new technology is aquaculture. As we began to look into an expansion of our food business we considered growing catfish in an indoor intensive aquacultural system. That is one of the interesting businesses we got into because we had a need to be broader on the meat side of the farm. We already were growing food for catfish farmers. We had technology that we had developed for fish nutrition.

I became interested because of my fertilizer experience; catfish farming had appeal as a water system. I knew how to run a water system. I said I could fix a water system so it can sustain an animal (fish) if I can find someone who knows how to raise the animal. We put the two together, and we planned to market our first catfish around Christmas time. That project is still in its infancy but is the kind of project that even a large organization can seize on and select the pieces that fit its own technology, its own culture, and its ultimate need.

So to answer the question as to what a big agricultural firm does to find the products, first it decides where it wants to go. It identifies the technologies it has, can buy, or can develop. It analyzes the markets and makes sure it can make a penetration into those markets. It looks at whom it will compete against. After the firm has done all that and demonstrated the technical feasibility of a proposed project, it tries to put a structure together, and to get the capital together. Capital always is a restraining factor. When I first got into emerging technologies I thought ideas were going to be the hardest thing to come up with and capital would be acquired easily. It is the other way around. A lot of ideas are held as to what can be done within Farmland's capability and the real problem is to develop the structure and to demonstrate the stamina required to overcome resistance to change.

It is unfortunate that my catfish technology has led me to one conclusion about the human scene. It's that we live in a dead fish society. I don't mean to be negative -- I am just referring to the way people are and the reluctance to take aggressive and effective action. One of the problems that comes up is that if we achieve success, we then have to deal with that success. We have to implement it. It is much easier to deal with dead fish than with the fish that grow.

A GENERAL FARM ORGANIZATION PERSPECTIVE OF
NEW CROPS/PRODUCTS

Bob Hitzhusen
Director of National Legislative Programs
Missouri Farm Bureau

I believe it would be helpful to separate my assigned topic into two distinct issues: (1) new agricultural crops and (2) new uses for existing crops.

Clearly the support in the farm community for developing new uses for existing crops remains consistently high. Development and promotion of products such as ethanol, corn-starch-based plastics, or soy ink enjoy a high level of support in the farm community.

In recent years, this support has been demonstrated by aggressive efforts in public policy to expand such markets through mandated use of certain agriculturally based products in government funded programs. A good example is the legislation recently passed in the Missouri General Assembly to require a certain amount of soy ink for all inks purchased for newsprint printing by the state.

At the federal level, the recently enacted Clean Air Act amendments will have the effect of greatly increasing the use of ethanol (and other oxygenated fuels) in certain metropolitan areas. Such efforts will likely continue to receive the almost unanimous support of the farmers of our state and nation in the foreseeable future. How such programs will be received by the non-farm public and in particular the "hunger lobby" is less clear and is a subject probably better suited to some other seminar and certainly some other speaker. But clearly from the farm community perspective there has been, and will continue to be, strong support for the development and promotion of new products from existing crops.

It's on the issue of new crops in agriculture that I believe the attitudes of farmers have changed significantly over the past 10-15 years. During the relatively boom years of the early- and mid-1970s, farmers were disinterested in any discussion of diversification. Then came the farm crunch years of the early 1980s and farmers began taking the topic of alternative crops far more seriously. That's not to say that there still isn't a certain level of built-in resistance to trying new crops but it's a hesitancy that can best be described as a healthy skepticism. And this is certainly understandable since new crops often involve at least three added risk factors:

- * unstable farm prices
- * higher production risks
- * often unsure markets

The role of the general farm organization is certainly not to be a cheerleader for any particular crop. In fact, given the great price shifts that can often occur from even a small increase in the production of an alternative crop, a general farm organization must be careful not to oversell or over-publicize any given crop. Our role is not so much to evaluate the economic strength and weaknesses of various crop alternatives as it is to pursue broader questions of public policy which directly or indirectly impact alternative crops.

The first obvious public policy question is the allocation of funds for research and development of new crops/products from agriculture. The growing federal budget crisis makes the funding of new programs increasingly difficult. In fact, recent references to "new" federal funds are often in reality a shifting or reallocation of funds from some existing program. It is relatively easy to convince a majority of the members of Congress to support new efforts in alternative crops/uses for agriculture as long as the program does not require too much in the way of appropriated funds. This makes task forces, studies, commissions, and other such approaches popular with Congress. A good example is the 1990 farm bill section establishing an Alternative Agricultural Research and Commercialization Center. It is one thing to authorize such an entity but the true test of Congressional support will come during the appropriations debate in coming years when decisions are made on how much money is to be devoted to such programs.

Another relevant area of public policy concerns the removal of any existing laws or regulations that may pose a deterrent to the development of new crops/uses in agriculture. A good example would be the additional planting flexibility contained in the 1990 farm bill which should prove helpful to farmers who are seriously considering alternative crops.

Finally, I believe farm organizations can assist in this area by encouraging and supporting a coordinated effort by numerous federal and state agencies and the private sector.

With farmers showing a greater willingness to experiment and try new crops, it is only logical that the farm organizations that represent them are going to be more visible and active in helping to promote the public policy issues that will assist with the development of new crops/uses from agriculture.

THE ECONOMIC DEVELOPMENT PERSPECTIVE
OF NEW CROPS/PRODUCTS

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Alternative crops and alternative products can make an important contribution to rural development. We have been missing some good opportunities to diversity production agriculture, and thereby to encourage the types of business and industry that can be located in rural areas of Missouri. However, two new Federal laws recently enacted should help encourage the types of activities that will result in rural development for Missouri.

Congressman Evans and Dr. Yetley discuss, in their papers, several provisions contained in the 1990 farm law and Clean Air Act. The farm law provides authorizations that are particularly important in two areas. First, it encourages the production of minor oilseed crops by allowing them to be produced on "triple base" and 0-92 (0-78) acres. Farmers producing crops on such acreage can still collect deficiency payments and receive a guaranteed minimum price of \$0.087 per pound of seed produced. This helps remove some of the uncertainty in producing the alternative oilseed crops.

Secondly, subtitle G of the farm law provides authority (but does not itself assure appropriations) for an Alternative Agricultural Research and Commercialization Center. Essentially, this subtitle not only authorizes research on alternative agriculture and resulting products, but also establishes a commercialization center for the purpose of providing funding to "search for new nonfood, nonfeed products that may be produced from agricultural commodities and for processes to produce such products...."

With further regard to previously-missed opportunities to enhance or encourage rural development, two items are particularly important. They bear on how the farming sector contributes to economic growth in rural areas (or fails to). The first derives from how completely the farmland resource is used. For a strong rural economy we need to utilize a larger portion of our farmland for producing commodities. In any given year, 60 to 90 million acres of the estimated 421 million acres (Soil Conservation Service estimate) lie idle. When this land is not producing, it reduces the volume of seed, fertilizer, labor, machinery and equipment, and other inputs that would otherwise have been used. This holds down business activity not only on the input side, but also on the marketing side.

A second shortcoming in U.S. agriculture is a failure to add value to our raw commodities, particularly those produced and sold

for export. In 1988 the U.S. exported in excess of \$40 billion in agricultural products, an estimated 51 percent of which was in unprocessed bulk commodity form (data of Foreign Agricultural Service, USDA). This percentage is compared with that for other exporting countries as follows:

Percentage of agricultural product exports
that are shipped unprocessed

Netherlands	2 percent
Germany	5 percent
Italy	7 percent
U.K.	8 percent
Australia	20 percent
France	25 percent
U.S.	51 percent
Canada	55 percent

Only Canada, with 55 percent, ships more of its agricultural products in bulk form than the United States does. A country noticeably absent from this list is Japan. Few, if any, of Japan's limited agricultural exports move in raw form. The Japanese are masters at adding value to virtually all items leaving their country. Adding of value creates jobs and provides income for their citizens, increasing their domestic tax base.

Thus, the agricultural sector of the United States can help improve and enhance rural development and its sustainability by utilizing a larger portion of our farmland base and by adding value to products prior to their movement to our urban sector or, especially, to export markets.

Probably the first question that must be asked is how we can bring more land into production when there's already a worldwide surplus of the major commodities. With perhaps a few exceptions, we can do so by diversifying beyond the traditional food, feed, and fiber markets. The obvious choice for diversification is to move into the industrial products arena. In that arena, agricultural commodities generally compete with feedstock materials based on petroleum products, not with other agricultural feedstock materials.

There are exceptions to concentrating on producing agricultural products for the industrial products markets. One such case is canola. Primarily because of the healthful characteristics of canola oil, the demand for the oil has skyrocketed since 1985 when the U.S. Food and Drug Administration granted the product a GRAS (generally regarded as safe) status. In 1989, canola oil valued at almost \$100 million was imported into the United States. At an average per-acre yield of 2,000 pounds of seed with an oil content of about 42 percent, approximately 500,000 acres of domestic production would have been required to offset the imports.

Industrial Feedstocks

Among industrial-type products, a variety of markets can be examined. Examples are

- * fuel
- * commodity chemicals
- * specialty chemicals
- * industrial products

Fuel. The 1990 Clean Air Act identified 44 metropolitan regions in which the carbon monoxide air quality standards were not being met. Gasoline consumption in these areas in 1989 was an estimated 36 billion gallons. The Act mandates that "clean" or oxygenated fuel be used in these areas for at least a four month period through the winter when pollution from autos is at a maximum. It is likely that at least 12 billion gallons of "clean" fuel would be required. Ethanol, produced largely from corn and blended as one-part to nine-parts of gasoline, produces an oxygenated fuel that can help these metropolitan areas meet the standards. In 1989, approximately 850 million gallons of ethanol were used in the U.S.

Additionally, the ozone standards mandated in the Clean Air Act were being exceeded in 96 metropolitan areas. Nine of the areas were mandated to begin using oxygenated fuel immediately. These areas are required to use "clean" fuel during the entire year, rather than just a four month period. The total quantity of gasoline that must be oxygenated to meet the immediate needs of the combined carbon monoxide and ozone non-attainment areas is estimated at approximately 30 billion gallons annually.

The remaining 87 ozone non-compliance areas are required to phase in the use of "clean" fuel over time. Seventeen areas are in violation of both the carbon monoxide and ozone standards.

Commodity Chemicals. Commodity chemicals are normally considered to be large volume, low margin type products. In most instances, at current price levels agricultural feedstock cannot compete with petroleum-based feedstock in the production of commodity chemicals.

Specialty Chemicals. Specialty chemicals are low volume, relatively high margin types of products. Generally, agricultural feedstocks can be competitive with those based on petroleum. This category of products is also good for "niche" markets where a small number of producers provide the total product necessary for a particular application. For instance, some perfumes use a derivative of erucic acid (the acid contained in the oil of crambe and industrial rapeseed) as a base for their product. The sales price of this product is in the \$20-\$25 per pound range. Of particular importance is the fact that significant price changes in the product have little impact on the quantity used, because the cost of the oil base, while rather high, is relatively small compared

with the price of the final product. Also, companies want to maintain a product of consistent quality. Although such products certainly provide high value added, the market size is limited.

Industrial Products. In this category of products from agricultural feedstock materials, consumer products would be made either from the agricultural feedstocks or from derivatives of the feedstock materials. This category probably has the greatest opportunity to enhance rural development -- assuming the value-adding intermediate and final product manufacturing remains in rural areas (preferably under local ownership).

A number of examples of industrial products could be named. Printers ink made from the oil of soybeans is currently used by over half of U.S. newspapers as a base for colored ink. The super slurper product made from corn starch was mentioned by Dr. Tallent. It is widely used in disposable diapers. Another product that was invented in the late 1960s, but has not been produced commercially, is an industrial grade nylon (nylon 1313) that can be used for parts under the hood of an automobile. Such parts include fuel lines and fuel tanks, battery cases, and others that must withstand relatively high temperatures while maintaining a constant size and staying impervious to absorption of chemicals. The feedstock for this product is brassylic acid, a derivative of the erucic acid of crambe and industrial rapeseed. These are just a few examples of products that have already entered the marketplace on a commercial basis, or that could become important in the future.

Product Development Strategy

Of paramount importance as we discuss alternative agriculture is to think beyond the question of what we can produce. We must have a vision well beyond the farm gate.

We believe that to be most successful, a consumer-product need must be identified. This amounts to conceptualizing a product that will be in demand in the marketplace. It may be targeted toward a widespread market or a particular niche.

As the demand for a particular product evolves, a "derived demand" will occur back through the processing and/or manufacturing activities and eventually encourage an increased demand at the farm level. When each of the elements of the system is in place and coordination is good among the relevant players, the chance for sustainable success will be optimal.

Rarely does a product enter the market with the apparent ease described above. Usually, it requires considerable work, expense, and time to bring all the pieces of the puzzle together. The persistence that is, normally required is usually done by a champion, that is, by someone who will persevere.

Economic Development Perspective

I now offer some ideas about how we can encourage economic development in rural Missouri via the adoption of alternative agriculture and industrial products. The desirable characteristics for such economic development will be somewhat of a Utopian list, because it is easier to name the items than to make them happen.

Local Firm/Plant Ownership. To the extent possible, local ownership of businesses will tend to keep the profits made by such a business at home. Conglomerate organizations will take much of the profits out of a local neighborhood, leaving less as part of the local multiplier effect yielding additional jobs and income in support businesses.

Plants and/or businesses must be large enough to enjoy enough economy of size to be able to compete with other companies, which may be larger. Some plants, such as ethanol production facilities, must be large enough for a huge annual output. This requirement has historically discouraged local ownership.

Some products can be produced economically in smaller size facilities. Where this is possible, local ownership and rural location are a more realistic possibility.

Diversification. Diversification usually helps rural areas survive when particular segments of their economy suffer economic downturns. Many areas are closely tied to production agriculture. If these areas can attract industries and/or businesses unrelated to agriculture, they can be somewhat less vulnerable to slow periods in agriculture.

Environmentally Sound. With the exception of a short period during the 1970s, little attention has been paid to both air and water pollution. The result has been a continuing deterioration of air and water quality throughout the U.S. Numerous local, state, and federal laws have been passed in an attempt to reduce all types of pollution. To the extent that new business and industry attracted to rural areas are environmentally sound, fewer problems will exist and profit opportunities should be better.

Growth Potential and Value Added. As a final note, it is good to attract types of business and industry where spinoffs will be possible. That will result in the best chance for sustainability.

To restate, I believe diversification, at both the farm and rural community level, into industrial feedstock materials and the manufacture of high value industrial parts can help our rural areas. To the extent that rural communities can attract businesses and/or industries that have as many of the desirable features listed above as possible, long-term success and economic viability will be enhanced.

A FARMER'S PERSPECTIVE OF NEW CROPS/PRODUCTS

Don Petty
Thompson, Missouri

I first became interested in canola about a year and a half ago. I read an article in a farm magazine which gave an 800 number I could call for information. I called. It turned out to be American Seed Company. I received a nice packet on canola, explaining how to grow it and all that was involved. Then in the spring I went to a canola meeting at Vandalia where I picked up more information. I decided to try it. Last year I had 16 acres. I planted it the 25th of September.

I learned that for canola one uses about the same fertilizer ratio as would be used for 60 bushel wheat, but with a little higher nitrogen requirement. Basically the only difference is to add about 60 more pounds of actual nitrogen to canola than to wheat.

My canola was harvested the 27th of June. It made 36 bushels to the acre. I had to haul the canola to the MFA at Glasgow. MFA was set up as a dealer and distribution point for taking in the canola seed, and this past year the dump points were Vandalia and Glasgow. I received \$4.86 per bushel. I didn't get rich from the canola but I didn't get rich on my beans, wheat, and milo either. The canola income compared favorably.

I like some things about canola. I planted canola as a second crop after wheat. I should explain that I sell insurance and specialty advertising to subsidize my farming just a little, and it was convenient to have all summer in which to prepare the wheat ground for canola. There was no conflict with harvesting other crops. Normally on wheat ground I chisel, then disk twice, run a cult mulcher over it, and then drill the seed. The canola is planted with the regular wheat drill, between 6 and 8 pounds to the acre. I like several features of canola. One is that it is not necessary to apply herbicides. If I plant canola on my wheat ground I will not have put any herbicides on that land for two years. It is necessary to use a little more fertilizer but I do not begrudge the cost of fertilizer as much as I do spending for herbicides.

The canola makes a very early growth in the spring and grows to about four feet in height. The foliage is dense and it smothers out most of the weeds. It gives good weed control. It has a deep tap root which helps break up the hard claypan soil that we have in Missouri.

When I harvested the canola on June 27 I immediately no-tilled it into soybeans, and the beans yielded 22 bushels. That was a good plus for the canola. I had some fields of beans that made 30-

plus bushels but others with lower yields; and the beans after canola did almost as well as the overall average for the earlier beans. I found it pretty easy to get a stand.

Of course, everything that has advantages has some disadvantages. The one disadvantage I have found in trying to get a stand of canola is that in a field where there is some clay, or close to a waterway that has been dug out and does not have much organic matter, it is a little harder to get a stand. The main reason, I think, is that it is hard to work clay land up real fine. If there are clods, the canola seed can drop down too deep. The seed needs only a very small layer of dirt on top of it, maybe an eighth of an inch.

This is basically my story on canola.

The Ruby and Mary Green Lecture

THE EVOLUTION IN EASTERN EUROPE

Robin Alison Remington
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University of Missouri-Columbia

November is a season of revolutions. On November 7, 1917, the Russian revolution set out on the road to socialism. Moscow became the mecca of a Communist world that by the 1980s included 16 countries, one third of the world's population, and some 90 nonruling Communist parties. On November 9, 1989, the Berlin wall came down, and the Communist monopoly of power in Eastern Europe collapsed. Whatever the problems of the "domino theory" as applied to Vietnam, it worked in reverse. As of November 1990 the only ruling European Communist party not to have gone out of business is in Albania, and even in Tirana Communist politicians have been shaken by the hurricane of change that swept aside four decades of Communist rule in the neighborhood.

Indeed, Eastern Europe has disappeared. In a geographic, historical sense, it never existed. Rather, when we talked about Eastern Europe we were using ideological shorthand for political/economic boundaries that divided Europe. We were separating out those countries in Central Europe and the Balkans that had undergone Communist revolutions, delineated largely by where the Soviet army stopped fighting as World War II ended.

Eastern Europe included the Warsaw Pact six -- Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland, Romania -- plus nonaligned Yugoslavia and isolated Albania. As a region, it had a population of some 137 million people. The eight constituent countries range in size from 3 million Albanians to 37 million Poles. They differ in natural resources, level of economic development, historical experiences, cultural orientations, nationality composition, languages, and religions.

Thus the Communist systems of Eastern Europe were superimposed on very different environments, and the Communist politicians have operated under widely ranging opportunities and restraints. For 40 years the crabgrass of political cultures invaded and partly neutralized the ideological superstructures coming from Moscow. However, Yugoslavia's socialist self-management and Romania's "socialism in one family" notwithstanding, the imperatives of the Communist sub-system, command economics, and "leading role" of the party created a collective East European identity from which not even Yugoslavia was immune. The legacy of shared economic problems, political expectations, and bureaucratic behaviors flowing from that identity is the womb of the multiparty political systems that are being born in post-Communist East/Central Europe.

In the 1990s politics has become unfrozen. Instead of imposed uniformity and ritualized, ideological jargon, East/Central European politicians speak with many voices. The political landscape that many Americans mentally colored Stalinist grey has turned into late Van Gogh. Western scholars and policymakers, like East/Central European voters, face the problem of sorting out signal from noise in political systems that are in the process of becoming.

The outcome of that process on a country-specific basis involves a tug-of-war between political pressures for fragmentation and economic pressures for the cohesion that is necessary if post-Communist East/Central Europe is to join the European Community's march towards European integration symbolized by Europe 1992. Much will depend on how fast politicians write or learn the rules of the new political game on which political parties survive, on the ratio of frustration to patience in populations who know they can throw out representatives who don't deliver, and on armies no longer inhibited by Leninist principles of party-army relations.

These factors operate differently in different countries. There is no precise way to measure them. They are in motion, producing constantly changing patterns and relationships. Post-Communist Eastern Europe is a political/economic kaleidoscope. Therefore, I suggest here a way of thinking about the process rather than present a scorecard of today's players, who may or may not be on the team tomorrow.

For our purposes I am concerned with six countries: four where, as of November 1990, the Communist party is a minority partner in a coalition government (Czechoslovakia, Hungary, Poland, and technically Romania), a reform Communist majority government with a non-Communist president (Bulgaria), and a Communist government whose ruling party has essentially withered away (Yugoslavia). I am leaving aside East Germany because, as of October 3, 1990, post-Communist East Germany evolved into an internal problem for a united Germany and as such will share -- if not equally -- German space in the common European home. At this point Albania has not evolved enough to be considered.

With respect to process in these six countries, political dynamics can be seen as a triangle involving the search for identity, security, and legitimacy. Let us look first at the issue of identity.

In this regard, on one level the revolutions of 1989 were a massive, popular rejection of ideological, class defined identity. The "nation" was rehabilitated. In post-Communist East/Central Europe, as William Faulkner would say, "the past is not dead. It's not even past." Here politicians and populations alike are attempting to go back to the future.

If you look at the map, the political implications of a return to historic national/ethnic identities are clear. For five of our

six countries this is the engine of the drive for fragmentation. There are growing demands for Slovene "sovereignty" within Yugoslavia, for autonomy for the 600,000 Serbian minority in the Yugoslav republic of Croatia. In Czechoslovakia, Slovak has become the official language of Slovakia, while the roughly half a million ethnic Hungarians living there may use Hungarian for official business in communities where they make up at least 20 percent of the population.¹ Even in Poland where 98 percent of the population is Polish, demographic/legal questions surround the ethnic Germans who live there.

This search for identify is a Pandora's box of visceral passions, historic enmities, and territorial irredentism. It is a politician's temptation and nightmare, inseparably tangled in the search for security and legitimacy. Among the political parties proliferating like mushrooms (by October 172 parties were registered in Yugoslavia) are those based on historic nations and others that view their mission as protecting the rights of national minorities such as the Turks in Bulgaria, Hungarians in Romania, or even Gypsies in Czechoslovakia. Whether or not these parties win in significant numbers, no Hungarian government, for example, can afford to ignore the plight of the Hungarian minority in Transylvania; nor can a Macedonian politician fail to speak out about what Yugoslav Macedonians consider cultural oppression of Macedonians in Bulgaria. Thereby the search for identity increases the number of flashpoints and potential for violence both within these post-Communist countries and between them.

In this sense security is very physical indeed. The situation changes the mission of armies from that of alliance obligation under the Warsaw Pact to that of an internal watchdog or possible instrument for dealing with regional foreign policy objectives. Despite the acknowledged end of the cold war and less of a perceived East-West threat, it is unlikely that a "peace dividend" for post-Communist East/Central Europe will follow the late-November Paris conference on Cooperation and Security in Europe, or the departure of Soviet troops in 1991. To the degree that security is comprised of enough hardware to buy peace of mind, that hardware will exist in post-Communist East/Central Europe.

This means that fear of national/ethnic (regional) conflict may deprive post-Communist leaders of the possibility of cutting their armed forces so as to redirect the flow of resources back into civil society. It brings up another dimension of security close to the heart of East/Central European workers and housewives: *economic security*.

The social contract of East European Communist regimes was that by accepting one-party hegemonic systems and limited sovereignty within a family of socialist nations, East European populations would have steady, if slow, improvements in their

¹The New York Times, October 26, 1990.

standard of living along the road to socialism. One of the reasons that Communist politicians adopted the borrow-now, pay-later strategy of the 1970s was to postpone cuts in subsidies on basic goods that their citizens had come to take for granted. Indeed when Eduard Gierek, the luckless head of the Polish United Workers Party, attempted to raise prices in the summer of 1980, food subsidies were eating up almost 40 percent of the Polish budget.

However, for soft currency economies hard currency debts are like being on cocaine. It is clear that by the 1980s, these economies were export driven and, even as much of the Third World, they were hooked. The imperatives of debt servicing that took more and more of their hard currency earnings depleted investment funds. In the beginning, hard currency borrowing was a band-aid. It was not a solution. The command economies of Eastern Europe needed major surgery. Along the way the attempt of East European planners to avoid the hard choices by what amounted to a credit card economy developed into terminal economic cancer.

With the dramatic collapse of East European Communist regimes, post-Communist politicians and planners looked to the market as a panacea. They are undoubtedly right that a "great leap" into market economies will mobilize whatever external aid is out there. However, the problem with relying on the market to regulate these economies is that market mechanisms come jointly with IMF (International Monetary Fund) austerity programs, unemployment, and inflation. When East European workers, students, and housewives took to the streets against their former Communist leaders, they did so in large part because their increasingly paralyzed command economies had failed to deliver. And it is at this point that the issue of economic security becomes tangled in the search for legitimacy by post-Communist politicians and parties.

In the first wave of euphoria, the tendency was to assume that political pluralism and free elections would legitimize the winners. It was not quite so. With the exceptions of Vaclav Havel in Czechoslovakia and Lech Walesa in Poland, post-Communist opposition politicians have lacked name recognition. Moreover, political democracy came too fast and too obviously from below for the politicians to take credit. Indeed, by their very nature the revolutions of 1989 have produced politicized populations with conflicting political demands and varying economic expectations.

All experts agree that for a market to go into operation, post-Communist workers, consumers, and potential entrepreneurs have to learn new ways of thinking and new ways of behaving in their economic roles. Workers have to become more productive for salaries that buy less. The subsidies must disappear. People must pay for goods and services at their actual value. For many East Central Europeans as individuals, things must get substantially worse before they get better. And economic security is not in the cards.

Poland was the first non-Communist coalition government since 1945 to take office. The Solidarity leadership has had mammoth problems with its attempt to apply Jeffery Sachs' "cold turkey capitalism" to the staggering Polish economy. As of November Lech Walesa and Tadeuz Mazowiecki, both Solidarity candidates, were squaring off in a battle for the Polish presidency. And whoever wins, this will be a winter of discontent and hunger for many Poles. In the West there is a feeling that we must "do something about Poland." What that something is may not be on line by winter.²

The other experiment with the "Polish road to capitalism" is less well known because U.S. media have been overwhelmed by the sound and fury of post-Tito Yugoslav politics and have largely given up reporting on anything but ethnic strife. Yet economically Yugoslavia is a relative success story.

In December 1989 Prime Minister Ante Markovic attacked an official 2,000 percent inflation (unofficially thought to be much higher) with a six-months anti-inflation package worked out with the advice of Sachs and IMF supervision. By April Yugoslavia had a minus monthly rate of inflation. Notwithstanding the negative impact of summer wage increases, the predicted annual inflation rate for 1990 is about 20 percent (unofficially probably something over 100 percent, according to my colleagues who are Yugoslav economists). Even the higher figure is virtually an economic miracle.

In January 1990 the 14th Congress of the League of Communists announced that the party accepted the principle of a multiparty system. When the Congress then went out of business because the delegations of Slovenia and Serbia could not agree on the direction of the rest of the reform program, Prime Minister Markovic flatly declared that Yugoslavia would continue to function with or without the Communist party. Since that time, it has functioned largely without.

During the spring of 1990, a center-right opposition won elections in Slovenia and Croatia. In June Markovic announced his intention to put together an Alliance of Reform Forces and hold federal elections by the end of the year. Serbian president Slobodan Milosevic countered by merging the Serbian League of Communists with its own mass organization, the Socialist Alliance, to form the Socialist Party of Serbia. Milosevic continues to seek his legitimacy in the whirlwind of Serbian nationalism that risks sabotaging Markovic's economic progress and threatens an outbreak of civil war.

These days the Alliance of Reform Forces is the only viable non-Communist federal party on the field. Markovic had substantial

²Not Mazowiecki but Stanislaw Tyminski was the second-runner, due for a run-off with Walesa. (Editor)

popularity. But voters have short memories. And if the predicted 8,000-plus enterprises in trouble go bankrupt, putting as many as 40 percent of Yugoslav workers out of work, that will not be an asset for the government party at the polls.

Ideally, the telescoping of the Communist monopoly of power into multiparty systems in East/Central Europe would allow these so-called "captive nations" to become masters of their fate. However, in the political economy of the forthcoming 21st century that is probably wishful thinking, unless we are willing to prime the pump of post-Communist economies enough to allow the fragile center-right coalitions to deliver a short-term economic performance while they attempt to consolidate electoral victories.

The most effective strategy would probably be for the European Community (EC) and the Bush administration to collaborate on a Marshall Plan for post-Communist East/Central Europe. Unfortunately, such collaboration does not seem to be a priority even for a NATO in search of a mission. The united Germany has major economic growing pains. The EC is taking some steps but probably not enough. In Washington those issues made no headlines during the agonizing reappraisal associated with the October budget negotiations that threatened to bring our government to a halt.

A fall-back position that would buy time and credibility would be to grant a three- to five-year debt servicing moratorium. The White House has suggested that such a move might be in order for Latin America debtors under some circumstances. But no mention has been made of East Central Europe in this regard. Indeed, as a key player in the State Department told me during a conference in Washington in October, post-Communist East/Central European countries are considered middle level debtors that must pay up because the interest they owe is on the plus side of our own budget when we negotiate deficit reductions.

Reportedly, Congressional legislation in the 1990 pipeline will provide "more than half a billion dollars as...an investment in East European democracy."³ Considering what we spent in lives and treasure to contain communism, that is not much of an investment in democracy. It does not look like a very serious "beginning," especially if we take Congressman Gephardt at his word that the Marshall Plan represented an investment that would cost \$82 billion today.⁴

³Congressman Richard A. Gephardt, "America's Role in the New Europe." Presentation to the Belgian Commission on Security Symposium on a New Security Model for Europe, Brussels, Belgium, February 23, 1990.

⁴Congressman Richard A. Gephardt, "American Leadership in the New World." Presentation to the Center for National Policy, Washington, DC, March 6, 1990.

As of late 1990, \$190 million is targeted for technical assistance. Peace Corps programs and exchanges are being extended to post-Communist East/Central Europe. As yet Congressman Gephardt's call in Brussels for "an expansion of the role of American agriculture in encouraging change in Eastern Europe" does not appear to have been translated into public policy. In these circumstances, efforts such as the European Greens' assistance to environmental parties, direct academic exchanges, and collaboration among universities symbolized by our own membership in the Alliance of Universities for Democracy, take on a crucial role.

Post-Communist East/Central Europe has evolved into a mixed bag of multiparty systems. This is political pluralism. In order for that process to result in stable, democratic polities, there must be a foundation for economic development.

Danger signals are already to be seen. For example, in Hungary with its creeping inflation, rising unemployment, and a growing army of homeless persons, the five-month-old center-right coalition led by the Democratic Forum took a beating in local elections last month in a campaign tainted by Hungarian chauvinism and anti-Semitism.⁵ Opposition parties won 20 of Budapest's 22 electoral districts. This does not affect the balance of power in the Hungarian parliament, but it reflects a public mood that is unlikely to improve as economic conditions decline. Without credible economic performance, post-Communist politicians will be reduced to nationalist rhetoric and anti-Communist witchhunts in their search for legitimacy.

In contrast to Congressman Gephardt's vision, the White House has tended to assume that we have won the cold war and can get on with other business. That is a misunderstanding of what happened and an overestimation of our own importance. We did not win anything.

When Mikhail Gorbachev removed the threat of a Soviet military veto,⁶ the populations of Eastern Europe threw out Communist governments that failed to meet their political and economic aspirations. The popular revolutions of 1989 established the preconditions for democracy and free market economies in East/Central Europe. There are no guarantees.

⁵The New York Times, October 16, 1990.

⁶This was a process that began with Gorbachev's commitment to socialist pluralism and restructuring of intra-Communist ideological relations at the CPSU 27th Party Congress in February 1986 (for English translation see New Times (Moscow), March 1986, p. 39) and concluded with his speech to the Council of Europe in Strasbourg July 7, 1989 when the Soviet leader insisted that social and political orders have changed in the past and may change in the future. Such change is "the exclusive affair of the people of that country." The Economist, July 15, 1989, p. 53.

As Americans, we have been given a chance to replay the charade of Yalta in which American indifference and British impotence allowed Stalin to swallow Eastern Europe in the name of Soviet security. My fear is that at this crucial juncture for consolidating the victories of 1989, the prospects for democracy in East/Central Europe will become the victim of Saddam Hussein's occupation of Kuwait and our own shift from the defense of Saudi Arabia to beating the war drums as a means of denying Saddam the benefits of Iraqi aggression.

Congressman Gephardt's hope that 1990 would become a springtime of democracy may be shriveling in the heat of Middle Eastern confrontation. While we are preoccupied with the "line in the sand," the people in post-Communist East/Central Europe may run out of patience as well as oil. If we destroy Kuwait in order to save it, the window of democratic opportunity created by the evolution of Eastern Europe could once again slam shut.

THE HISTORY OF CANOLA COMMERCIALIZATION

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I will begin with the history of the commercialization of canola in the United States, and expand to make a few projections about where canola and rapeseed in general are going. Then I will backtrack and present a little history about rapeseed that I believe has applicability to what is going on in commercialization now. Finally, I will attempt to identify some key areas where there are challenges or problems with canola, and where work needs to be done.

I go first to the future and our judgment about the potential for canola because there is no point in reviewing history unless a sound canola enterprise is in prospect. In my opinion and that of our company, if canola is destined to be only a 100,000 or 200,000 acre crop, or even a half million acre one, it is not possible to justify devoting as many resources to it as we and others are now doing. We think, though, that the crop will become more substantial than that. I offer some of the reasons for our judgment.

I begin with projections of population but more significant is the make-up of the complex of consumption of edible oils. We think edible oil consumption will outrun the growth in population. We estimate that by the year 2000 about 14.8 or 15 billion pounds of oil will be consumed. How much of that can canola capture? The situation in 1990 is that canola holds about two to four percent of the relevant components of the edible oil complex. It is probably one or two percent of the total edible oil complex, but of those components within which it can compete it is in the three to four percent range. Our expectation is that during the 1990s canola will move up to a 15 percent share of those components of the edible oil complex. At that market share, within the roughly 15 billion pound total consumption, we arrive at around two billion pounds of canola utilized annually.

That volume of consumption equates to about \$500 million gross value of canola oil produced. This is domestic consumption only. A key question bearing on whether canola expands to a 15 percent share, or even just 10 percent of its market, is whether it becomes a true commodity-priced oil. Recently, canola has traded in the United States at something of a premium relative to the commodity oil complex. My view is that if canola were to retain a premium price, its potential would be more nearly a seven to nine percent share of its addressable market. My feeling is that for canola to become a truly successful crop and a big opportunity, it needs to do so as a commodity priced crop.

As a brief note on the other parts of the edible oils complex, if in fact we eventually increase our oil consumption as fast as we

predict, we will be producing something like 1.7 million tons of meal. That is a 36-percent protein meal. It typically trades at about 75 percent of the value of soybean meal. So at today's prices this amounts to about a \$200 million annual meal product.

The big question, in the final sense, concerns what it all means on the farm. Is it profitable to produce canola on the farm? Can we in fact get production up to the point where we can meet that projected demand? If we were to do so, we would be devoting some 2½ to 3 million acres to the crop, for domestic use. At an average yield of about 40 bushels and a farm price of around \$5.00 a bushel, that amounts to a farm value of around \$500 million.

If the value is calculated for the final oil and meal products, the value is something like three quarters of a billion dollars. These values can be regarded as significant, enough so to interest people in doing development work on canola.

In order to explain what is going on now, I touch briefly on past history of rapeseed and canola. Rapeseed has been around for a long time. It has been used as a lamp fuel and a cooking fuel. I have a Swiss grandmother who was born in 1897. She told me rapeseed oil was used in Switzerland when she was a girl, both for cooking and for lamps. She said I am not so modern.

In the 1930s rapeseed was introduced into Canada. It languished until World War II, when production was expanded fast as a part of the war effort. Rapeseed oil was the best possible oil for use as a lubricant in steam engines. It was used in steamships and such.

Just after the war, with the advent of diesel engines, the usefulness of rapeseed oil as a lubricant dropped off. Farmers in Canada felt as though they had developed a viable crop, and rapeseed oil began to move more and more into edible use. In the late 1950s and early 1960s some issues arose regarding the erucic acid content of the oil. Erucic acid is the fatty acid that has several valuable applications in industry as a lubricant, but in health studies questions arose whether it had deleterious effects in the human body and in mammals in general.

That led to an effort in Canada through the 1960s and the 1970s to develop types of rapeseed with very low levels of erucic acid. In 1971 or 1972 the first low-erucic-acid variety came out of the breeding program there. In 1974 the crop was improved further by introducing varieties that were low in neoglucosinolates as well. These are sulfur-containing compounds that have a negative effect in feed. In 1978 the Canadians coined and trademarked the term canola to describe these new types of varieties. That was a turning point for the rapeseed crop in that a wholly new type of product was introduced into the marketplace.

The key threshold with respect to the United States came in 1985 as the Food and Drug Administration decided that the 11-year

interval seemed to be long enough to evaluate the oil. It allowed the use of canola oil in U.S. food products.

Rapeseed is currently the third highest volume oilseed produced worldwide. Soybeans are first, cottonseed second, and rapeseed about ties with sunflower for third. Rapeseed as a class is produced in China with its 12 million acres (most is neither low-erucic-acid nor low glucosinolate; China has primarily the old types of rapeseed). India also has about 12 million acres. Canada has seven to nine million acres of canola -- specifically canola. The EEC has about four million acres of a product which is primarily low-erucic-acid in the oil component but probably half is still high in glucosinolates with the other half being true canola -- the EEC produces what are called either single or double lows, and expects to be on the double low standard, which is nearly equivalent to canola, by 1992.

Finally, Eastern Europe seeds approximately three million acres of rapeseed.

About the time the Food and Drug Administration approved canola, we began to hear a lot about the impact of various kinds of fats in our diets. Increased use of canola has been driven by the fact that canola contains only six percent saturated fat, the lowest saturated fat content among vegetable oils. Also noted recently is that canola oil is relatively high in the mono-unsaturates. Depending on whom one talks to in the health research field, quite a few people are saying that in fact what we are looking for in an ideal oil is a high ratio of monounsaturates to saturates. That ratio is optimized in canola oil. The perceived health benefit of canola oil -- irrespective of whether it is entirely real -- is what has to date driven the bulk of the canola oil use in the United States.

The impact has been dramatic. U.S. canola oil imports expanded fast in the 1980s, as Procter and Gamble changed their Puritan oil to 100 percent canola. At the same time most of the major food companies began to evaluate the use of canola oil for their products. Labels on foods in the supermarket show a canola content ever more often.

When canola was first used, the food processors were required to list it on the label as low-erucic-acid rapeseed oil. Shoppers were not enamored by the term rapeseed. So it was a notable event when, in 1985, the Food and Drug Administration approved the use of the term canola. After that change, canola began to show up on more and more labels.

If you read the news you know of an apparent increasing concern about total fat consumed, as well as specific types. When Congress passed the 1991 budget, it included among the provisions a requirement for new labeling on food products. We will await the final regulation, but the law calls for specific details on labels as to the total amount of fat in the product as well as data on the

specific portions that are saturated and unsaturated. To the extent that consumers become more aware of questions about the fat complex in foods, I think the result will be a stronger demand for canola oil.

This is where the challenge comes in. I have translated canola use figures into acreage equivalents. In 1989 the United States imported an estimated 220,000 metric tons of canola oil; the acreage equivalent is about a half million acres. We think that last year about 40,000 to 50,000 acres of winter canola were seeded, and 30,000 to 40,000 acres of spring canola. In the current (1990-91) season, the winter plantings may be about 80,000 to 90,000 acres. So the key question on commercializing canola is less one of acceptance in food uses than of expanding its production on the farm. How do we bring acreage and production into line with present utilization?

We believe that the bulk of the canola acreage in the United States is now concentrated in the Midwest, with a scattering on the periphery. The epicenter is still in the Midwest, although production is increasing rapidly in the Southeast -- in Georgia and South Carolina.

Looking ahead from where we are, I see the first challenge as having to do with production experience and expertise on the farm. When canola was introduced, farmers had no previous experience, and little research work had been done. As to the genetic base, in the mid-1980s only a few varieties were available. Testing experience was limited, and most was done as farmers accepted the risk of trying the available varieties. Until the mid-1980s there was essentially no breeding effort. (That situation has changed, as I will note later.) There were no state trial systems and only a limited national trial system.

We had, and still have, and probably will have for several years, real problems with having the proper array of crop protection chemicals available for use. Currently we have one herbicide, Treflan, with a national label for use with rapeseed and canola. We may or may not have one insecticide registered on a limited basis (opinions differ). No fungicides are registered for use with the crop. One fungicide is labeled for use as a seed treatment.

In spite of significant strides the last two or three years, marketing remains a limitation for farmers in many parts of the country, including Missouri.

Farming is a political business, driven to some extent by politics. There were, in my judgment, disincentives under the 1985 farm law to growing canola.

Let me now give you an overview of where things now stand. Agronomic research on canola is going on in a number of states. A few have substantial programs. Missouri does, as do Kentucky, Tennessee, Georgia, Michigan. Others are involved in only a

limited way. One of my priorities for the next several years is to encourage more funding for agronomic research on canola.

The biggest challenge of the moment is to increase the confidence level in the mind of the farmer -- to give him confidence that he can produce a profitable crop on an ongoing basis. If you look at canola yields across the country, in any region there are farmers who have done fabulously well. A few have done OK, breaking even. Some have lost money. One of the problems is that we still need to find reliable systems for producing the crop. I believe the most promising route is agronomic research. In a moment I will talk about genetics. We can improve the genetics, and work is underway, but at the moment the varieties available are not the crucial limiting factor in getting canola established with good experience on the farm.

So I say, there is good news because work is underway but there are challenges ahead in agronomic research.

A field study in Kentucky is of interest. Kentucky looked at double cropped soybeans following winter wheat as well as following canola. Beans planted on the same date, June 30, behind canola and wheat, came out with substantially better yields following canola than wheat. The same kind of work was done at Tennessee and two other schools and the results were similar: that the incremental yield on double cropped beans following canola was something on the order of 5 to 8 bushels as compared with beans double cropped after winter wheat. The difference is worth something.

With regard to genetics, three primary companies, including mine, are breeding winter canola, and the University of Idaho has a very good program. I believe all these companies have germplasm licensing agreements with foreign companies. The majority of the canola varieties that are being sold currently in the United States come from Europe, usually Germany or France. So at the moment the U.S. canola industry is running on germplasm developed elsewhere, screened thoroughly in the United States, and then released. The first hit for U.S. developed varieties is a variety released this year for southeastern production, and I think we will see, in the next few years, more U.S. developed varieties.

I referred earlier to a lack of trial testing other than looking at farmers' fields. A national winter rapeseed trial system is in place and has been growing. Missouri has one location. Last year the national trial, run by the University of Idaho, had 20 locations. Not fewer than 66 different canola varieties were being examined.

Additionally, a number of states have instituted their own state variety trial systems. This is the second year for a state variety trial in Missouri. A few states have had three years' experience (Kentucky, Georgia, Ohio, and Michigan). New trial systems are in place this season in four states. I believe this activity reveals a lot of interest in canola.

Canola is a bit touchier than many other crops as to agronomic traits. Shattering at harvest and winter hardiness must be dealt with. Disease problems, especially blackleg and white mold, are a problem in the South and Southeast.

I turn to the oil side of the crop. Procter and Gamble advertise that canola has no more than six percent saturated fat. In fact, we have not yet produced a crop with a fat content so low, especially in the winter crop. Even the Canadian crop is not consistently below six percent, and the six percent specification is attained there by blending oils from two different areas.

The average winter crop in the United States has had an average of 6.4 to 6.7 percent saturated fat. If canola becomes more of a commodity oil in the future, the saturated fat percentage will become less of an issue.

We have challenges in increasing the overall oil content. On the meal side we have challenges in reducing further the glucosinolate content of canola, as well as reducing the fiber content, which becomes a limiting factor in feeding the meal. Also, several projects are underway to address the total protein content of the meal.

Crop chemicals are a challenge with perhaps a long lead time and many dollars attached to it. The object is to develop products acceptable to the EPA. The good news is that chemical companies are now addressing the possibilities. The biggest concerns have to do with fungicides and insecticides. Herbicides are of secondary importance.

One of the challenges with canola that has been with us since 1985 has to do with markets. In 1986 I began to hold grower meetings. Invariably, questions would be asked about where to market the crop. I replied that the market was in Canada. Now there is a plant in Chattanooga, a converted soybean crushing plant. A peanut plant in Augusta, Georgia, began crushing canola in 1990. There has been a plant in North Dakota. A Montana plant is about to begin operation, as is one in California. I think we will see an increasing number of soft seed plants, primarily sunflower or cottonseed plants, come on line. The conversion can be made readily. Eventually we may see some soybean crushing plants essentially become switch plants, crushing soybeans part of the year and canola at other times.

There are challenges in finding the capacity and capability in country elevators for handling the crop, and then putting together the whole transportation system for getting a crop to the final crush point. Missouri has had the problem of how to put the system together on a cost-effective basis.

On the political side, in 1989 the U.S. Canola Association was formed, as a grower-led group, with the object of helping commercialize the crop. It has had a broad agenda. The specific

priorities have been to get some kind of equal footing for canola under the farm programs. In 1989, soon after being formed, its lobbyists were able to achieve for canola considered-planted status on a limited portion of the permitted program-crop acreage. This was a good deal for farmers who had a 100 percent base on their farms; unfortunately, it did not do much for the economic returns side of the crop, in comparison with program crops.

The new 1990 law has several features that are favorable to canola. Canola planting is allowed on the flex (triple-base) acreage; canola continues to have a degree of considered-planted credit on payment acres; and a marketing loan has been established for canola. The most exciting development is that canola planting will be allowed on 0-92 acres, and the crop will essentially be able to receive the deficiency payment that would normally go along with the program crop.

To indicate what I think the economic impact is, I have compared winter wheat with winter canola. By my figures, in market net return, canola has had something like a \$50 to \$100 an acre advantage in net return over winter wheat. But the deficiency payment for wheat has offset much of that advantage. Farmers have often asked, "Why bother?" Open market canola has had no advantage over program-subsidized winter wheat. But with the 0-92 program now in place for canola, adding \$40 to \$90 value for the crop, farmers may be convinced that canola is more profitable than the alternatives.

I summarize much of the past history in terms of asking what is important in commercializing the crop in order to make it effective. A myriad of things need to happen. The good news is that a number of groups believe in the crop. And I take heart from knowing that we are progressing a lot faster in canola than the early record shows for soybeans.

I end with a crystal ball view about what the canola crop means in the United States. There are three broad categories of rapeseed: canola, high-erucic-acid rapeseed, and a modified fatty acid profile crop. Several substantial companies are working through genetic engineering and other means to modify the fatty acid profile of the rapeseed plant entirely. The object is essentially to produce custom chemicals from rapeseed. In the case of my company we have a number of contracts with other companies that call for us to come up with domestic supply sources for types of oils which are currently available only offshore, as well as to come up with entirely new types of fatty acid chemistry for specific applications. I don't mean to minimize the opportunity in canola, but beyond that maybe the icing on the cake is that modified fatty acid profile crops are coming. Within the next three years we will begin to see them in increasing numbers. I think they represent an additional substantial opportunity on top of the base opportunity that canola represents.

MAKING THE PIECES COME
TOGETHER: RESEARCH

Robert Myers
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I propose to give a general overview of research needs for canola that we see here in Missouri. Dr. Minor will follow with examples of specific research projects underway and will present data he has collected in his project.

Two other individuals on our College of Agriculture faculty are actively involved in production research on canola. They are Dr. Jeanne Mihail in Plant Pathology and Dr. Ken Kephart in Agronomy. Other persons in other departments, particularly several in Agricultural Economics, also are engaged in research.

First a note on the rationale for working with alternative crops -- my perspective on why we should be involved in research, whether the crop be canola or some other one. Everyone has heard about economic and ecological diversification. If we look at our traditional crops it becomes obvious that we have changing economic conditions and changing environmental conditions, particularly weather, that we have to deal with. Alternative crops allow us to diversify and to adjust to changing circumstances. From a pest-control standpoint, it is good to have more diversity in our agricultural system. There is interest in developing more value-adding opportunities for the rural sector. What can be done to bring some processing plants or some packaging opportunities to the small communities so that not only farmers benefit from the new crops but also the communities near the farmers?

We want to optimize the uses of our resources such as land. Missouri, a diverse state, has many different types of soils. We can hope that new crops will reduce commodity surplus problems -- a familiar idea. And as Dr. Yetley observes, we are interested in looking at agriculture not so much from the traditional viewpoint of supplying food, feed, and fiber, but as a renewal resource base for providing a large array of products that can be produced in a renewable fashion.

Looking specifically at canola, which is the case example for this seminar, we need to ask first, in a state such as Missouri, "Where do we want to put the crop?" Many factors can be looked at, such as soils, climate, and competing crops; also, how canola can fit into a rotation; the available transportation for getting the crop to market; and access to labor. Certain alternative crops such as canola may require more labor than the crops previously grown in an area.

Also relevant is farmers' previous experience with new crops and specifically with producing them under contract. Fortunately, we are getting to the point with canola where we can, in some cases, take the crop to a regional elevator but in some other instances we might want to contract the crop. This is particularly likely if we are working with the industrial version. Certainly we need to inquire about possible pest problems. And where will we find our markets?

We can pull all these considerations together by means of a technique called Geographic Information Systems. I have begun a project in Agronomy, cooperatively with the Geographic Resources Center on our campus, in order to do that. We try to relate, mathematically, some of the site-specific characteristics in a way that allows us to choose those parts of the state that seem most logical for producing various alternative crops. That seems to be a faster and more precise procedure than to make trial runs, raising the crops all over the state for a long period of years. If this approach works in Missouri, it could be extended to the entire country.

When a site has been chosen, the next step is to try to adapt the crop to its soils and weather. In research we need to look at tillage and, with canola, specifically at seedbed preparation. We consider fertility, and investigate drainage too as canola does not like wet soils. As to weather, we can examine planting dates with the object of minimizing the winter kill problems that can be serious with canola. We can consider irrigation as a way to get the crop established in the fall.

With regard to variety selection, always important, what can be do as researchers to identify which types of germplasm will be most helpful to our farmers? How can we assist companies that are developing these varieties? We can look at rate of germination and seedling growth, with the object of getting the crop up and growing with a good fall stand that will survive the winter. What is canola's tolerance to Missouri winter conditions? Then we consider rate of spring growth. Once the weather becomes warmer, how do we get that crop up and flourishing so that it can outcompete the weeds and accumulate a lot of vegetative growth, getting into the reproductive phase while we still have spring moisture?

Disease resistance is more of a problem than insects and weeds. Diseases could be the principal limitation.

We want efficient nutrient utilization so that input costs for the crop can be kept down.

We give attention to uniform pod maturity. Present varieties of canola have an indeterminate growth pattern, similar to that of soybean varieties. Pods develop on the earlier growth of stems so that there is a differential rate of pod development. The older pods have a potential for shattering before the newest pods are mature. Because of that growth pattern, we have to delay the

harvest a bit in order for the last pods to mature. That may prevent getting the crop out of the way before the wheat harvest, and delay double-crop planting.

Establishment of stand is the key for canola as well as for most alternative crops. Studies are getting underway on germination requirements. Again, as to seedbed preparation we find in Missouri that no-till can present problems. In one experiment we were not able to establish the fall-planted crop in no-till.

Time of planting: Dr. Minor has some data, and timing is critical to winter survival. Seeding rate is important but not as important with canola as with some crops because of canola's ability to branch and fill in spaces just as soybeans can do. So canola does not need as precise a seeding rate as corn does.

Soil fertility is certainly something we need to think about, in terms of getting a good stand that will survive the winter.

A wealth of information has been accumulated about traditional crops. Extension personnel, researchers, people in input supply industries, and farmers themselves can walk into a field and identify a problem. But with a new crop that body of expertise is not available. It is necessary to develop it, to learn how to identify, for example, nutrient deficiencies. Some weeds can be a problem with alternative crops. And for any alternative crop we have to ask whether there will be wild relatives. In Missouri wild mustard can be a problem for canola production.

Some canola-producing areas south of Missouri have had serious insect problems. Diseases are certain to be a problem, requiring crop rotation. We have begun a multi-crop, multi-year study on rotations. Ken Kephart and Jeanne Mihail are looking at diseases. There may be other stresses that we cannot predict.

With canola or any crop, we have to think about growth and development from a management standpoint. Canola's winter dormancy -- what happens within the crop that allows it to get through the winter? We study spring flowering and pod development and try to evaluate the physiological maturity of the seeds. To my knowledge we do not have good visual indicators of when the crop is physiologically mature; that is, how can we know when it has achieved its maximum dry weight and the seeds have become viable? Yet that information is important for management.

Canola has several advantages. We don't have to worry about cultivation, as it is a narrow-row crop. We can combine it with the grain heads that may be on hand for small grains or soybeans. But we do need to adjust for the small seed size. The seed is tiny. We can apply duct tape to holes in grain trucks or in the combine. Or we might adjust the combine -- the screen sizes and air movement and so on -- so that the grain does not go out the back. A number of alternative crops present problems owing to the physical nature of the seeds.

With regard to utilization research, once we have taken the crop through the season, what can be done to assure that the harvest can be sold for a profit? We have an excellent Food Science department here at the university. Some of the staff persons are taking an interest in canola. The attractive feature is that the oil is relatively low in saturated fats. There may be other reasons the oil would be desirable from a nutritional standpoint. More research would be good.

In the case of a number of alternative crops, they may initially be raised for food purposes but their long run potential for industrial purposes is worth investigating. I am not thinking of erucic acid obtained from industrial rapeseed, but possibilities that we cannot identify or predict now. Although Cooper Evans remarked at this seminar that we should focus primarily on industrial crops, I prefer a broader approach. It is impossible to know what the various uses for a particular crop may prove to be. We all know the soybean history. It began as a forage crop. Then it shifted to being an oilseed. Many persons would say the driving force is now the meal market. Also, the soybean has industrial uses that were not foreseen when research was begun. I prefer to look at alternative crops from a diversification standpoint and not be too concerned about whether their immediate use seems to be industrial or edible or fiber or whatever.

What about the feed value of the canola meal? Some researchers in animal science are interested. We want to learn how it competes with soybean meal or other oilseed meals. Another topic of interest is the fall foliage. It dies when winter arrives; is there a way we can make use of it? Also, the grazing possibility: Dr. Minor is interested in that.

Although I will not touch on the educational role of Extension, I ask what we in research can do to facilitate farmers' adoption of a crop. We in research can look at the profit potential -- the yields, input costs, any kinds of utilization that would improve the market.

Research in alternative crops itself contributes experience that is then available to the state. We look also for ways to ease management. It's best to be able to use equipment already on hand. We want to minimize risk. Canola will have more variable yields than traditional crops do. Variety development can do much to stabilize yields but better management practices can help too. My own work can be viewed as our trying to relieve farmers of some of the risk load.

On-farm research has the added merit that it makes it possible for farmers to become more familiar with a new crop.

Research funding. Unfortunately, research for canola or any alternative crop runs into limitations. We have been told at this seminar that the USDA itself is addressing industrial crops; hence, it is hard for us to get research funds for canola from the USDA.

The National Science Foundation, as a major funder of research, does not like to fund agricultural activities. Further, it prefers basic research; but most research on alternative crops falls in the applied category.

No check-off funds are available for alternative crops. It is hard to get much industry support for a new crop. Few federally funded experiment station projects are underway on alternative crops. My own work comes under not a federal project but Missouri's special Food for the Twenty-first Century. I am one of only three or four agronomists in the country who focus their research primarily on alternative crops.

To summarize, we in research see problems or what may be called problems or challenges, depending on the point of view. Many persons on campus are interested in canola and similar new crops. We have a good group of persons who will tackle the problems and meet the challenges.

MAKING THE PIECES COME
TOGETHER: EXTENSION

Harry Minor
Extension Agronomist
University of Missouri-Columbia

I will give an overview of what we try to emphasize when we in Extension talk to growers about canola. Several of us are involved. Lou Meinke worked with us for two years, doing much of the management research and taking over part of the Extension responsibility. Recently, Dr. Ken Kephardt came to our staff from Idaho where he had worked with canola and rapeseed for eight years. He brought a body of experience that had been lacking here.

When we talk to growers we try to keep everything in a realistic focus. Canola is an exciting new crop. We have been working with new crops for many years and rarely does one come along that strikes us as having as good a potential.

We should acknowledge that Eric Rey's company contributes to grower knowledge. Technical service comes with every bag of seed his company sells. My impression is that Tony Ballman, located in Missouri, is in touch with every farmer who buys the Ameri-Can seed.

Scarcely mentioned at this seminar is the fact that canola and rapeseed cannot be grown in close proximity. Utilization differs for the two crops, yet the two will intercross. So the two should not be grown near enough to each other that intercrossing can take place. In states such as Idaho, where both canola and rapeseed are being grown, the growers have got together and divided the state into districts. Thus geographic separation is achieved.

In Missouri we have nothing similar in place. Separation is pretty much being brought about by commercial demand for the product. In central and northern Missouri the market is for canola, and only that is being grown. Ron Utterback, who follows me on this program, may comment on MFA concerns. Rapeseed is grown only in the Bootheel. Availability of contracts for producing the crop is holding it to the area.

As production expands for canola, rapeseed, or both, this issue will have to be dealt with.

We started our work with 1987 plantings. That was our first experience with the crop. It was a variety test. We wanted to learn about the adaptation of the crop. We came out of that with a favorable impression but, more importantly, we gained some needed experience. I believe that because of Extension's involvement in applied research we have been able to stay one step ahead of

farmers. We have taken the findings of our applied research to farmers.

One concern as we talk with farmers relates to the expectations they have. We outline a program in a way to help them understand how the crop is to be produced. We show the ranges of yields we have had in three years of variety testing. The 50 to 60 bushel yields at the high end of the scale look good, but there has been a zero yield; and the low end of the scale has been 30 to 40 bushels. Production data from neighboring states such as Illinois and Kentucky, where 10,000 to 15,000 acres have been devoted to canola, suggest that the averages are in the 35 to 40 bushel range. So as we talk to farmers about canola and look at performance it is somewhat of a challenge to divert them from the highest yields as realistic expectations. We prefer to keep their sights in the 35-45 bushel range.

The second challenge concerns date of planting. We have looked into dates by trying a wide range of planting times. In general, the October 10 planting date that is normal for wheat does not give very good results for canola. Yet very early planting leads to winter kill. September plantings seem to do pretty well. Data from Kentucky confirm that in a year such as 1989, when cold weather came in December, even late September planting can run into trouble. So we are now talking about early to mid-September planting dates.

Of course questions arise as to where land will be available in early to mid-September. Usually it will be available following a wheat harvest. Little corn and very few soybeans will have been harvested by that time. July harvest of wheat offers the best possibility.

I want to point out again that if we get a good stand from fairly early planting, good ground cover is attained by late fall, and that is fine from a conservation standpoint.

At the other end of the season, it appears that in our latitude canola and wheat mature and can be harvested at about the same time. Eric Rey points out an advantage of having canola as a predecessor to soybeans in a double cropping system. A part of that advantage is the earlier maturity of canola; there may be other factors, but in our experience the two crops mature at a similar time.

Don Petty took off some high moisture canola last year and was able to establish soybeans at an earlier than normal date but he could have taken off high moisture wheat and done the same thing. It is our opinion at this time that the two crops offer an equal opportunity for double cropping.

Some data that I have put together compare the yields of wheat and canola in side by side tests and invariably wheat out-yields canola; and if we plug in a \$3.50 price for wheat and \$5.00 for

canola, in three of the four years canola has an income advantage over wheat. Data we have here on campus show that to be a fairly consistent relationship. So we think that canola can compete with wheat in our farming system. With the availability of acreage permitted by the new farm bill, we think there will be an opportunity for canola as a new crop.

Another difference a farmer needs to be alert to is that we are dealing with a crop of very fine seed. The planting requirements are a little different from those for wheat: to get a good establishment a finer seedbed is needed, with somewhat firmer, better depth control, and a little more moisture. One of the negatives is that a fine seedbed is more erosive, at least for the establishment period, than is the case for wheat, for example.

Yet another place where we need to get farmers to change their thinking applies to nitrogen requirements for this winter-produced crop. Most farmers will grow wheat after soybeans, applying 60 to 80 pounds of nitrogen during the production season. Canola at a 40 bushel yield will take up 120 pounds of nitrogen -- for a higher yield the nitrogen requirement likewise is higher. These figures are uptake and part can come from the soil; but if canola is seeded after wheat not very much residual nitrogen will be available. So high yields will require high nitrogen application rates.

One of the reasons for the high nitrogen requirement for canola is that a high protein-content seed is being produced. It is 35 to 36 percent protein once the oil has been extracted. Soybean fixes its own nitrogen but canola is not a leguminous crop and the nitrogen needs to be applied in the system.

If the canola stand is uniform, the crop does well in controlling weeds. That, I think, is fortunate. As Eric Rey mentions, there is only a limited availability of pesticides for the crop; and only one fungicide. Environmentalists should like canola, as it is a virtually pesticide-free crop.

In harvesting, duct tape is a useful item. A rather large volume of material is run through the combine. The forward speed on the machine is somewhat slower than the customary speed for wheat or beans. I believe the speed is about two miles an hour. That means that as a scale of operations is planned, it is necessary to have more machinery available or reduce the size of the area.

Also, the crop is fairly susceptible to weather injury once it reaches the mature stage. The mature crop should not be left to be exposed to rainfall or heavy wind, as the varieties we have available today are subject to shatter losses.

Once the harvest operation is complete, some seed is left on the ground. Even a one percent loss from a 2,000 pound yield is 20 pounds. If we note the 6 to 8 pound planting rate we see that more seed is left on the ground than we started with. Volunteer crops

are always a question among farmers. A question regarding canola is whether the volunteer growth can be grazed. Or can we plant canola and graze it as we sometimes graze early planted winter wheat?

We have gone into the volunteer crops, and put up our canola forage sign. We try to look at things positively and we have measured from such plots a ton of dry matter per acre, with a 17 percent protein content. We have started a more intensive program to learn what the overwintering ability of such a crop may be after the crop has been harvested for forage in the fall.

In Extension we have used all available methods to help farmers understand the canola crop. We plant plots of wheat and canola in side by side comparisons. We have interacted with farmers; we have listened to them. Their questions have helped direct our research. We have tried to avoid missing opportunities to carry the information we have gained to the producing public.

MARKETING PERSPECTIVES AS THEY RELATE TO CANOLA:
POSITION OF MFA, INCORPORATED

Ronald Utterback
Vice President, MFA, Inc.

MFA, Incorporated's position as a member-owned farm service and supply cooperative is to meet the needs of its owners, the agricultural producer, in the markets it serves.

Our cooperative is charged with maintaining its growth, so that it is a viable economic entity today and tomorrow, positioned to serve its owners and patrons. Because we must always be attuned to the future, and because the owner/customer looks to MFA for those services he will need, the management is willing to consider seriously the alternatives available to the Mid-American farmers, and is in fact excited about them.

MFA welcomes the opportunity to participate in the development and introduction of new crops and products when they are believed to have a reasonable chance of filling a market demand.

MFA is multiple in its participation in that it prefers to participate in all facets of crop introduction from the seed distribution and the supply of fertilizer and chemicals, to the marketing of crops, where practical.

My specific charge for this panel is to discuss the marketing issues associated with the crop canola.

It is my historic observation that for a cash crop to become established, a nearby delivery point must be in place so that a

producer can deliver it from the field as harvested as well as continually from his own farm storage. However, an elevator operation is faced with the dilemma of requiring enough volume to justify its involvement.

This past season MFA offered producers of canola three delivery points in Missouri -- Lexington, Vandalia, and Glasgow. Due to the low harvested acreage in the Lexington area, it did not participate but rather assisted the producer in moving his product to the Glasgow outlet.

Vandalia MFA received and shipped daily to the Glasgow market. From this central site, all production was trucked to the Central Soya Crush Plant in Chattanooga, Tennessee.

Problems associated with this first attempt were primarily volume related. Vandalia and Lexington were completely unsure of the production to expect, and had the volume been sufficient, each would have delivered directly to Chattanooga. However, the lack of experience and the severe handling characteristics of the crop gave rise to typical fears of economic loss for the elevator management. The problems encountered are as follows:

- * Volume -- too much or too little
- * Storage and handling qualities and characteristics
- * Fineness and containment of the seed -- ability to aerate it
- * Fear of conditioning loss -- if too wet, spoilage results
- * Fear of grading loss due to a lack of knowledge
- * Fear of contamination from other crops at the elevator -- wheat, corn, soybeans, etc.

In addition to these uncertainties, the aforementioned locations were handling a large wheat crop as well as completing the planting and spraying of the spring seeded crops.

All of these fears and problems revolved around the possibility of economic loss to the elevator manager's operation. Time, experience, and familiarity tend to eliminate several of these problems. However, in the short run the operation is measured by profitability.

Elevator operators and marketers are willing to take risks if the opportunity for gain is adequate. We recognize that the crop has a high probability of success in the future of agriculture in Mid-America.

We do not believe that we can justify making large investments in people and assets in the short run, but would rather position ourselves to grow just ahead of our producer demand.

Canola's potential in our market is not as high as, for example, soybeans until new adapted varieties are developed that will address production problems such as the narrow time windows

for planting and harvesting, and the problem of shattering. Until then the crop will be an alternative and not a major player.

If we believe what the biotech researchers are telling us, all that will come to pass. Canola will then be a serious contender in the vegetable oil and specialty oil markets. We also believe that the crop may be grown under contract for variety-specific traits. We are led to believe that the crop is readily adaptable to biotech manipulation, and that could make it a contender in a wide variety of special uses. Should this develop, specific growing areas could be established for a specific type of canola, not unlike the current seed production areas of the Willamette Valley in Oregon, the seed sorghum production areas of Texas, or the cotton and rice areas that are type-specific.

The management of MFA, Incorporated believes some unique characteristics are associated with Missouri and its ability to produce and market canola and other niche crops.

Like most Midwestern states, we have developed a production and marketing infrastructure that is geared to soybeans, corn, and wheat. However, we also have smaller markets developed to handle a diversity of crops such as cotton, rice, fruit, grapes, and small seeds. Additionally, because of the nature of the diversification, soil types, and topography, our average farm size has not grown as rapidly as that of other states in this latitude.

We have in place many small operators who as of now are widely diversified in row crops and livestock. They are looking for alternate crops and livestock enterprises that will add to their farming enterprises.

Because these producers are in place, MFA still maintains many of the facilities and services for smaller, more diversified operations.

Across Missouri are many small, older grain and seed handling facilities. These could be set aside specifically to handle newly emerging and unique crops if the producers and elevator operators can be shown the economic opportunity for returns and if the crops can be contained regionally in order that economies of scale can be implemented.

This means that considerable education and development must take place. MFA is willing to assist in the process. We are willing to develop locations to receive canola and other special crops if potential for adequate return exists.

We can best accomplish this if product areas can be identified and concentrated such that producers and suppliers in a specific region can grow together.

MFA is willing to offer services to alternative crop producers and end users when economic benefit to both is possible.

Marketing services we can develop include the following --

- * Acting as a contractor for specific production acreage between an end user and a grower
- * Receiving, conditioning, cleaning, packing, and storage
- * Forward contracting
- * Deferred payment
- * Grading and testing

As stated above, I expect we will see, in the future, specific varieties of canola grown for even more specific uses than cooking oil. We can participate in these situations and are willing to provide marketing services as production volume increases.

As a footnote, the following firms are involved in processing for end-use canola --

- a. Ameri-Can Canola and Central Soya currently have the most accessible processing facilities at Chattanooga, Tennessee.
- b. Archer-Daniels-Midland has a crush facility in Windsor, Ontario, Canada.
- c. A crush facility is located in North Dakota.

And lastly, it may be asked whether MFA is willing to invest in processing facilities. The answer is, "Not at this time." However, we will entertain the opportunity when and if it is presented. We do not visualize ourselves as a processor or value enhancer of products for use out of the producer (farmer) supply line. However, we do not close the door on opportunity if it is economically justifiable.

MAKING THE PIECES COME TOGETHER
IN MISSOURI STATE GOVERNMENT

Kevin D. Dunn
Staff Assistant to Director
Missouri Department of Agriculture

Just a few years ago soybeans was considered a new crop. In fact, it took over 200 years for soybeans to be considered a commercial crop. Yet, for as long as I have been aware of soybean production, I cannot remember a time when soybeans has not been just as traditional as corn and wheat. While only 2,000 acres of canola were planted in Missouri in the fall of 1990, it is probably only a matter of time until canola production becomes a much larger portion of Missouri's crop receipts. Imports into the United States have increased from 2,000 metric tons in 1984 to 200,000 metric tons in 1989. Imports of canola are now the equivalent of approximately 500,000 acres. Consumption of canola oil is expected to double by 1995, and its share of the edible oil market is expected to increase from one to 17 percent by the year 2000. Puritan brand cooking oil marketed by Procter and Gamble is totally canola based, and other manufacturers are following suit due to the nutritional qualities found in canola oil.

With all of these amazing estimates and predictions, why were only 2,000 acres of canola planted in Missouri? Three factors stand out as responsible for the low acreage: farm policy which did not encourage new experimentation; lack of knowledge on growing and production methods, specifically for Missouri; and finally, lack of processors within a reasonable distance of canola production in Missouri. Fortunately, some of these roadblocks are disappearing. The research being done now at the University of Missouri is successfully determining the northernmost boundary for planting canola without severe winter kill damage. Other research is nailing down the specifics on production, nutritional needs, harvesting procedures, and rotational requirements.

The 1990 farm bill has provided new incentives for encouraging production of alternative crops without losing acreage base -- a base that had required years to acquire. Specifically, the 15 percent triple-base provision along with the oilseed marketing loan and 0/92 (or 0/78) program will encourage the production of crops such as canola.

The question of locating processors in Missouri is sort of like the chicken and the egg scenario. Processors don't want to locate until production is sufficient for their capital investments, but on the other hand, producers don't want to produce until they know that a market exists for their product. Progress is being made as each segment steps farther into the water, including the encouraging of production through forward contracts. Additional steps can be taken to encourage canola production and

processing within Missouri, and state government can definitely play a role in helping bring these pieces together.

As perhaps everyone is aware, in addition to being an importer of canola oil our country is a big importer of high-erucic-acid rapeseed oil used in plastics and for other industrial purposes. Consequently, the potential for increased production of industrial rapeseed exists as well. However, because canola is also a rapeseed, the two types cross pollinate, resulting in a canola too high in erucic acid to be used for food purposes and a rapeseed too low in erucic acid to be used for industrial purposes. Therefore, if Missouri is to become involved in producing both types of rapeseed, a method must be devised to prevent cross-pollination of the two types.

I now discuss briefly how other states are dealing with rapeseed production to prevent cross pollination. One possibility is to outlaw one type of rapeseed throughout an entire state. The other possibility is to form growing or production districts within the state so that both types of rapeseed may be produced. Two states that have chosen this avenue are Washington and Idaho.

Washington developed its growing districts through a grass-roots process that involved growers and handlers of canola, together with others who might be interested in growing and processing the crop. A system was devised to divide the state into growing districts according to natural geographic boundaries because natural barriers would be much more successful in preventing cross pollination than would man-made boundaries. As a result, 12 districts were formed in Washington.

Next, a district committee made up of local growers was formed within each district, and this committee, through local input, determined which type of rapeseed, if any, would be grown within that district. Two of the districts opted out of rapeseed production entirely, and the districts which originally opted for high-erucic rapeseed production have now switched so that only canola is now produced within the state. The system does remain in place to switch to industrial rapeseed production if a market develops within the state.

A producer may grow an off-type in a district if the producer petitions the local committee and receives an agreement from his neighbors saying that they will not produce a rapeseed that could cross pollinate with his. To prevent an off-type from being spread throughout a district during hauling, regulations exist which require the off-type to be covered as it is hauled through the district.

The state of Washington has also passed certified seed laws to prevent importing of diseased plants. Rapeseed is susceptible to several diseases -- more so in warm, wet climates than cool, dry ones. A disease such as blackleg can be completely devastating to the production of rapeseed. Blackleg, which is a seed-born fungus

that travels from the plant residue and soil to the new plants, became so prevalent and devastating to certain areas of France and Australia that these areas could no longer grow rapeseed. Blackleg was also brought into Kentucky. That development was attributed mainly to producers' not following proper rotational methods.

Washington also requires that seed be chemically analyzed for erucic acid content, oil content, and glucosinolate concentration.

Guidelines have been established for distances that must exist between different species of canola to retain the purity of the seed, including brassica napus, a self-pollinated canola, and brassica campesteris, a cross-pollinated canola. Most of these policies came from those developed in Canada, Sweden, England, and France -- countries that already had experience in canola production.

The state of Idaho established seven production districts. One district allows only edible; one allows only industrial; three allow industrial without restrictions and edible with restrictions; and one district prohibits all commercial rapeseed production. The districts are not as autonomous as are those in Washington and must petition the state for changes. Guidelines such as distances between species for certified seed are the same as those in Washington.

Currently, the Missouri Department of Agriculture has no legal authority to regulate the production of rapeseed. The most successful plan for implementation will involve the input of everyone involved in canola and other rapeseed production and must be carefully thought out and planned rather than just arbitrarily made. This seminar is an important step in the process by opening up the dialogue so that concerns, needs, and expectations can be expressed. Whatever decision is finally made, the Missouri Department of Agriculture can be very effective in working with producers in implementing a plan of action for ensuring successful rapeseed production.

Beyond regulation or production to prevent cross pollination, the Missouri Department of Agriculture can become involved and play an important role in other areas as well. Seed quality standards and analysis have played an important role in the marketing success of canola in Washington state. Currently the Grain Inspection and Warehousing division of our department provides laboratory analysis for corn and other commodities on a user-fee basis. The potential exists for analysis of canola, including oil, erucic acid, and glucosinolate determinations. Some analysis, such as gas chromatograph, requires additional expensive equipment; user fees, if implemented, could help cover these additional costs associated with rapeseed analysis.

The Grain Standards Act contains no standards for rapeseed analysis. A process for inspection of common or industrial rapeseed is described in the U.S. Agricultural Marketing Act.

Canada has developed standards for analysis of canola, and the standards used in Washington are similar to those used in Canada. By next year, however, the U.S. Grain Standards Act is expected to contain standards for analysis of canola, and these standards will probably be a hybrid of standards used for industrial rapeseed and those used in Washington and Canada for canola.

In addition to helping provide techniques to improve the marketability and uniformity of canola through seed analysis, the Missouri Department of Agriculture can play an important part in marketing through the Market Development division. Attracting processors will continue to be an important goal. Marketing specialists within the division work closely with processors and could be instrumental in encouraging processors to locate in Missouri. Providing producers with marketing information is important to entice producers to produce new crops and continue production. Just as marketing summaries on a daily and weekly basis are provided for commodities such as corn and soybeans, such information could also be provided for canola as markets are firmly established.

The Agriculture Development fund, a program within the Market Development division of the Department of Agriculture, has developed a Missouri Alternatives Loan Program designed specifically for ventures into new crop and livestock production. Up to \$15,000 could be provided to a farmer interested in growing canola, and a loan of this type is especially beneficial if farmers have difficulty obtaining financing for alternative enterprises through traditional avenues. Through market summaries, working with producers and processors, and alternative financing, the Market Development division can be effective in canola growth.

We believe that the divisions of the Missouri Department of Agriculture can provide various services for canola producers, and the department is willing and ready to be a working partner in making the pieces come together in Missouri.

SUMMARY OF THE SEMINAR*

William D. Heffernan
Professor and Chairman
Department of Rural Sociology
University of Missouri-Columbia

Missouri agriculture may be viewed first of all as a part of a globalized food system -- a worldwide network dominated by a relatively few transnational firms. Our U.S. portion of that world system also is marked by a high degree of concentration. Some of the firms are our own, others are foreign, and still others operate as domestic-foreign joint ventures.

Where does Missouri agriculture fit in that vast interlocked system? Our state's farming sector is comparatively small, of course. In several respects it does not fit very well. We have to say that if our agriculture were to remain as it has been, without venturing into new kinds of enterprises or without being able to take advantage of new markets, its future would not be very bright.

Missouri has areas of rich farmland that are highly productive and can compete in conventional crop production. But some of Missouri's land is marginal. Moreover, the state's rural areas have underemployed people. Missouri's land and human resources do not accommodate themselves well in the global food system.

Missouri therefore has a lot at stake in the possibilities for economic development via new crops and products from agriculture -- the topic for this seminar. Moreover, a number of other states also are seeking new opportunities for an agriculture that is over dependent on traditional products.

The word that may best express our interest, heard often at this seminar, is diversification. Missouri needs that.

Seminar speakers weaved back and forth between emphasizing new crops and crop products, and species of animals too, on the one hand, and new or enlarged industrial uses for farm products on the other. Dr. Tallent of the Agricultural Research Service, for example, emphasized the work of the four Regional Research Centers of the U.S. Department of Agriculture, which are devoted primarily to developing new industrial uses for farm products. The four labs are celebrating their 50th anniversary in 1990.

At the same time, a large number of new crops and animals are being newly produced. Some of them are truly new to our area.

*This paraphrased digest was prepared by Harold F. Breimyer.

Others have been known for a long time and are coming back into prominence.

No opportunity to bring employment and income to Missouri farmers and rural areas should be overlooked. A number of the so-called new crops and animals offer possibilities. They can be rare ones such as some ornamental shrubs or even ostriches, or as old-hat as the fresh fruits and vegetables whose Missouri market is no longer supplied fully by the state's farmers. A sociologist pricks his ears when he hears sentiments such as, "Real farmers don't produce lettuce and carrots." Whether farmers call themselves real or something else, maybe more ought to try doing that.

Various other comments about new crops were heard during the seminar. One is that forest products ought not be overlooked, whether really "new" or merely underappreciated. Another is that some new crops (new to Missouri) have certain features that make them attractive. Canola and rapeseed, for example, are soil-conserving crops. They hold topsoil in place. Also, the fall-seeded varieties lend themselves well to double-cropping.

Canola, I was told, was featured at the seminar because it is already coming into Missouri agriculture. It served also as an illustrative example. Experiences with canola illustrate what lies ahead for any food or industrial crop that offers promise.

Canola is now imported. Demand for it will likely outrun population growth because its edible oil enjoys a high consumer acceptance. The crop holds considerable promise.

Even though the seminar generated some enthusiasms, it seems unlikely that new crops and animals will meet all the income and employment needs of rural Missouri. No "soybean Cinderella" looms on the horizon. It would take a lot of crops, each attractive to perhaps 100 farmers, to add appreciably to Missouri's farm income. The individuals engaged will welcome the dollars they can get, but the totals are unlikely to add greatly to state income statistics.

The greater potential, if it can be realized, lies in expanded industrial uses for farm products. New or expanded uses could be developed for crops that are now the mainstay of Missouri agriculture. Or new uses could expand markets for less familiar crops. One possibility, also illustrative, lies with high-erucic acid rapeseed, which lends itself to various industrial products, even automobile motor parts. It would be nice to think of Missouri's automobile assembly plants as putting together parts made from the rapeseed oil of Missouri farms. The idea is not outlandish.

And if we want to let our imagination run further, maybe we can start a fad to put brightly colored tires on those Missouri-assembled autos -- and make them biodegradable too.

It was said often at the seminar that more research is needed to develop industrial materials that can be derived from farm products. Mr. Evans opened the seminar by recounting how interest at the federal level has blown hot, blown cold. To use his figure of speech, following an earlier surge of activity, new product R&D was put on the back burner a little more than a decade ago. Dr. Tallent followed by noting that it is on the front burner again. Work is going on now, including that at the four regional laboratories. It is not futurology; it is here-and-now.

Getting new processes accepted and into production is a real hurdle. Yet the experience to date in doing that, often hesitant, offers something of a bright spot for rural areas. Very large firms, we were told, are reluctant to venture into new products. Generally, new processes have usually been introduced by smaller companies. In fact, the common pattern has been for smaller companies to do the innovating. Then, if they are successful, they are bought out by the giants.

Irrespective of whether we like or dislike that prospect for the longer run, we can expect that many of the innovations in industrial products derived from agriculture will be introduced by smaller firms. Often they will be located in smaller cities, to the benefit of the rural areas of Missouri and other agricultural states.

Perhaps every conference ends on a note calling for jointness of dedicated effort. This one is no exception. All the alternatives for Missouri's (and other states') agriculture reviewed at this seminar require a major combined effort by farmers and agribusinesses; by private interests and government; by the legislatures and executive branch at all levels of government; and of course by the various suppliers of venture capital. The potential benefit from successful cooperative enterprise is great enough to encourage all of us to "get with it."

