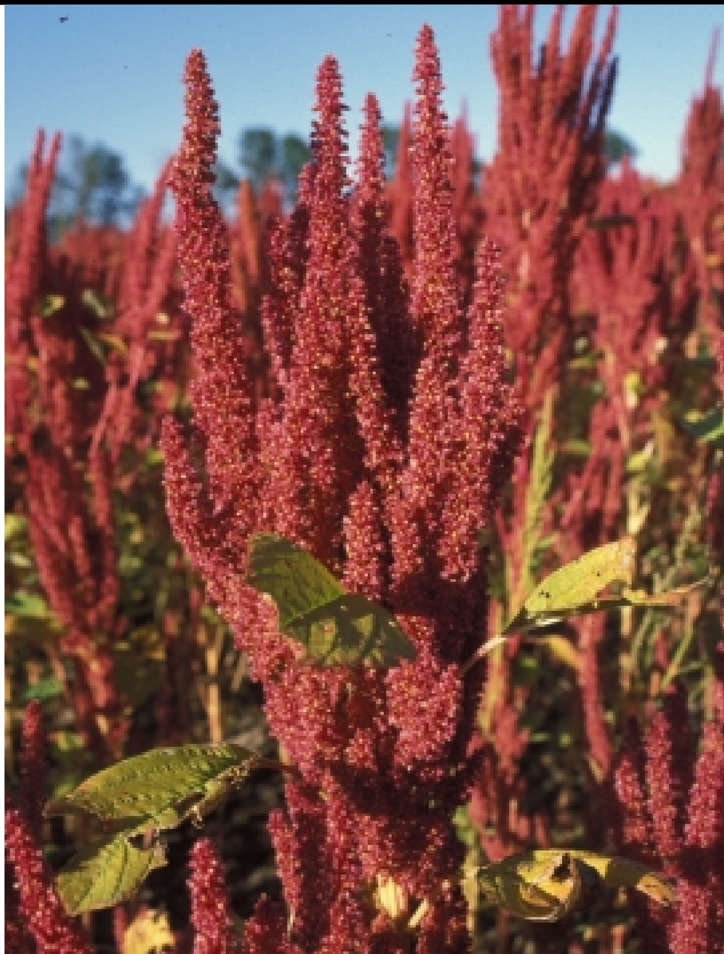

Strategies for Commercializing New Crops

Report of a Workshop
February 27-28, 2003
St. Louis, Missouri

STRATEGIES FOR COMMERCIALIZING NEW CROPS

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Executive Summary

To improve our collective understanding of how to successfully commercialize new or alternative crops, a workshop on “Strategies for Commercializing New Crops” was held in St. Louis in February, 2003. A diverse group of agricultural experts from academia, government, and private industry came together to discuss strategies for commercializing new crops. This paper is the outcome of that workshop. It provides a background on the benefits of new and alternative crops, and the barriers which have made commercialization difficult. Past approaches to commercialization are outlined, with suggestions on how to improve commercialization success in the future. Key factors identified by workshop participants include: allocation of risks and rewards among commercialization players, providing supply chain management in response to market pull for a crop, limiting participation in commercialization (exclusivity) to avoid overproduction, developing public-private partnerships, and conducting effective business and organizational planning. There was strong general agreement that new or alternative crops offer many potential benefits, and should receive greater support, despite some of the policy, market, and institutional barriers that exist.

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Introduction

On February 27 and 28, 2003, fourteen individuals with diverse backgrounds, from across the U.S., met in St. Louis, Missouri, to discuss the process of new crop commercialization. The goal of the workshop was developing a better understanding and consensus on ways that new crops can be commercialized in the U.S. The workshop, entitled "Strategies for Commercializing New Crops" was convened by the Thomas Jefferson Agricultural Institute[1] and the University of Missouri, with funding from the USDA-CSREES Fund for Rural America program. Participants included scientists, economists, farmers, government leaders, and private sector representatives with expertise in marketing, variety development, processing, legal and organizational issues (for a full list of participants, see appendix 1). This paper is based on discussions held at that workshop.

New or alternative crops are those that are not traditional in a given farming region. They usually serve to diversify the crops grown in a cropping system, rather than totally replacing an existing commodity. Some new or alternative crops are grown elsewhere in the world, but are new to a region. Others are crops new to the modern marketplace, either having been recently domesticated or resurrected from "lost crop" status.[2]

Importance of New Crops

As modern agriculture has developed, the production of crops has become much more mechanized and input intensive than was historically the case. Along with changes in equipment and farm inputs, there has been an

increasing emphasis on fewer and fewer commodity crops. In many areas of the U.S., farmers are reliant on just one or two crops for their income.

The focus in many regions on just one or two crops has left crop farmers more vulnerable to weather, pests, and market forces which can erode their farming income. By contrast, the more diversified cropping systems used on some farms have been found to provide several benefits, including enhanced profit, reduced environmental impact, and better distribution of labor.

Diversification of crops can enhance profit both by providing a higher income on alternative crops, and by boosting the yield of other crops in the rotation. A number of farmers have been able to benefit by growing new crops which go into a different market than their commodity crops. For example, if livestock numbers decline, reducing the demand for feed crops like corn and soybeans, a farmer growing alternative crops for non-feed markets will benefit by avoiding those price dips on part of their income.

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[1] The Jefferson Institute is a 501(c)3 non-profit education and research center based in Columbia, MO. The Institute was founded in 1997 and has a primary focus on crop diversification. More information about the Institute is available at www.jeffersoninstitute.org or by calling 573-449-3518.

[2] Crop domestication refers to the process of taking a wild plant species and adapting it to have traits more desirable for human use, through a process of plant selection and improvement. "Lost crops" are those which were domesticated for human use in earlier centuries, but have not been regularly used in the last century. "Alternative crops" are those not normally grown in a given region, even though they may be common elsewhere. "New crops" are those which are being newly developed for commercial use, and may be new to a country's agriculture or new to significant economic use.

Environmental benefits from diversification can vary, but generally include less need for pesticides and enhanced soil quality. If legumes are added to a rotation, less nitrogen fertilizer is needed. Certain crops, especially ones that provide winter soil cover (such as winter canola), can help reduce soil erosion. Other crop alternatives have lower water needs, allowing expensive irrigation watering to be reduced or eliminated.

Finding time to complete labor tasks during busy planting and harvesting seasons is a particular challenge for farmers who rely on just one or two crops. Most of their income generating labor may be compressed into just a few weeks of the spring and fall. Farmers who grow several crops normally are able to spread out the time during which they can plant and harvest, allowing a better overall labor distribution.

Barriers to New Crop Development

Farm policy barriers. There have been a large number of barriers to successful commercialization of new crops, ranging from policy and institutional barriers to a lack of plant breeding and market development efforts.

Policy barriers have typically come about because the federal farm programs focus on supporting major commodities. Most crop-related policies are written just for common commodity crops, with the unintentional result of excluding alternative crops. The impact is most significant for price support programs which provide a substantial boost to commodity crop income, but not to alternative crop income. This makes it difficult for alternative crops to economically compete. Even if the alternative crop has comparable profit to a traditional commodity, the financial safety net of federal commodity payments makes both farmers and farm lenders more comfortable with traditional crops, despite benefits that can be provided from diversification.

Less obvious are the many other ways that alternative crops get excluded from farm policies. Crop insurance is generally not available for smaller acreage crops. This not only makes them more risky, but can make a farm lender unwilling to loan funds for the expense of growing an uninsured crop. The irony is that diversified cropping systems are less likely to require large crop insurance payments, since weather and pest problems seldom affect several crops at once. Lack of crop insurance has been one of the significant barriers to adoption of many new crops.

Minor acreage crops have recently gained more government consideration in registration of new herbicides and pesticides, but a lack of private sector incentives to develop pest control products for small acreage crops leads to few, if any, options beyond mechanical and cultural means of pest control.

Government export programs have almost always been limited to major crop commodities, although occasionally a minor crop receives temporary federal support through food aid purchases, such as USDA purchases of buckwheat for Russia or chickpeas for the Middle East. These export investments are small, however, in comparison to the export assistance provided to major crops, ranging from direct financial subsidies to government funded marketing efforts. By contrast, there is no government investment in reducing imports of various crops, even though many of those could be grown on greatly expanded acreage in the U.S. (such as sesame, flax, and canola).

Even in farm conservation programs, where diversification should be a natural fit, alternative crops usually get short-changed. A farmer who plants a crop unfamiliar to a local conservation agent may be excluded from receiving conservation payments, or may not receive appropriate credit for the benefits in erosion control or reduced irrigation demand which an alternative crop may provide.

R & D barriers. Development of new or alternative crops has also been held back by a lack of research support. One of the most critically needed areas is plant breeding. Most new or alternative crops have had little, if any, modern plant breeding. In the few cases where modest breeding programs have been undertaken with new crops, rapid advances have often been made. For example, three publicly-funded plant breeders, each working part-time on pearl millet, were able to more than double grain yields and develop types much better suited to mechanical harvest.

Other areas where lack of research has been a barrier range from utilization research to collecting economic and market data. Most government-funded statistics programs focus on major commodities, as do economic modeling efforts. Little is known about not only crop acreage of minor crops, but also their potential market uses. While limited studies have identified many promising traits with alternative crops, these potentially valuable characteristics have received little attention in research programs. Even where traits have been investigated, such as unique starches in amaranth grain, methods of efficient processing have not been developed.

While some scientists are quite interested in working on new crops, there is little funding support available. Competitive grant programs usually favor “basic” lab science over applied research. Commodity groups and private industry have funded applied crop research programs in the U.S., but only on the major commodities. The USDA Agricultural Research Service does operate research programs on a few new crops, but needs complementary partners and funding to help bring its efforts to faster fruition.

Infrastructure barriers. Although much of the existing commodity crop infrastructure can be readily adapted to alternative crops, there has been almost no effort to do so. Grain elevator managers lack the motivation to handle non-commodity crops, making it hard for farmers to find local delivery points for alternative crops. While most grain crop equipment can be used with alternative grains and oilseeds, there is usually a lack of information on how to make fine-tuning adjustments to optimize equipment for those crops.

Many of the barriers discussed above can be attributed to a lack of knowledge by policy makers about the benefits of new or alternative crops. Also, there is almost no political incentive to develop policies supporting crop diversification, despite the costs and problems associated with a heavy reliance on commodity-driven farm policy.

Past Commercialization Efforts

With the benefits of crop diversification in mind and an awareness of the barriers to diversification, it may be instructive to consider the approaches used with past efforts to commercialize new or alternative crops. These approaches, or models, have varied significantly depending on the crop. In general, commercialization efforts have become increasingly dependent on exclusivity. Participants in commercializing a crop may have either exclusive access to the seed, to processing, to the market, or some combination of the three. Where exclusivity has not been involved, there have been examples of alternative crops going through a period of strong demand/interest followed by over-production.

Examples of new crop commercialization models which have been used

1. Traditional model - characterized by public germplasm and processing open to all potential producers. Soybeans would perhaps be the most successful example of this “traditional” approach, where improved germplasm and varieties were developed initially through public funding, followed by development of several private soybean processors.

2. Modified traditional model - characterized by privately developed germplasm and open access to processing. Sunflowers and sorghum are two crops essentially developed by this approach.

3. Restricted germplasm access - characterized by control of improved germplasm (varieties) by a single group or company. The key to potential success of this approach is that the germplasm which is restricted to the group must be significantly superior (or believed superior by buyers) to other available germplasm. In some cases, it may simply be a case of having the only commercial quantities of seed of a particular species. Crops following this route include meadowfoam and sesame. In theory the processing of the crop could be done at more than one location, but in practice it is typically done by the company/organization controlling the seed supply.

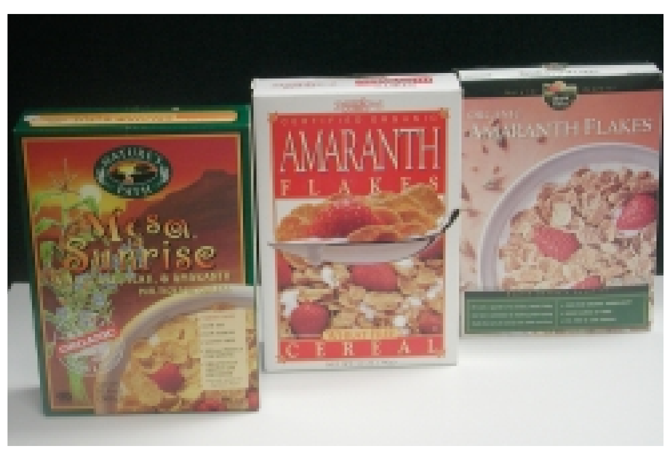
4. Restricted processing access - characterized by control of unique processing facilities. These facilities are unique because they are not available in other accessible locations or are greatly superior than other processors at producing a lower cost or higher quality product. Germplasm is not controlled by the processing entity. Crambe has largely been developed in this model.

5. Complete company control - characterized by one company controlling seed, selecting growers, and serving as the only buyer/processor of the crop. This approach has been used in a few small scale situations by single proprietor companies, such as for teff and kamut.

Models 1 and 2 have been the most commonly used approaches to new crop commercialization. While tradition has played a role, so has the reluctance of the public sector to engage in private sector “exclusive” approaches. Under ideal circumstances, the traditional model is perhaps preferable because it allows the potential benefits of the new crop to be available to everyone. However, the reality is that the traditional approach has led to a frequent boom-bust cycle with many new crops, as described below. Amaranth, proso millet, dry beans, and many specialty fruits and vegetables have fallen victim to the unstable dynamics created by unrestricted entry into production and brokering/processing.

Why Efforts to Commercialize New Crops Have Often Failed

Several efforts to commercialize new crops have resulted in either faltering progress or failure. Why these failures have occurred was discussed by workshop participants. There was agreement that the most common symptom of these unsuccessful efforts is a **boom-bust cycle**, where enthusiasm initially runs high with a crop. An initially attractive price may attract a relatively sizable amount of production, leading to more product than a fledgling market can absorb. The



prices then crash, leading to a rapid exodus of growers (and possibly processors) from the market. These initial growers, many of whom feel "burned" by lower than expected income from the new crop, will often foreswear future involvement with the crop, not to mention becoming voices of discouragement to future efforts with new crops in their area.

A problem that has sometimes contributed to the boom-bust cycle is the unequal allocation of rewards and risks among participants in new crop commercialization. A broker contracting for initial acreage of a crop may look at the crop as an opportunity to "get rich quick." The individual may offer a relatively modest price for the crop, while inflating the yield expectations of the farmers (thus making it seem like high yields will compensate for the modest price). These over-estimates of yield can be due to over-enthusiasm of the promoter or outright deception, but lead to farmers taking a significant risk, resulting in loss of income. More rarely, the opposite has also happened, where a small number of growers requested such high prices for producing a new crop that it was impossible for the processor to make a profit. These experiences indicate that exclusivity alone is not enough to help ensure commercialization success, that there must be farmer involvement and a sharing of economic risks and rewards.

Another way of looking at the allocation of risks and rewards is to acknowledge that some individuals or groups seek to become "free riders." Free riders[3] are those who seek to share in the profit of a new enterprise without having to bear any of the risk. For new crop commercialization to be successful, insitutional innovation may be needed in a way that provides positive feedback to collective contributions and limits attempts by individuals to be free riders. Such change can be

difficult when past government policies have in some cases, made it very feasible for individuals or private companies to easily reap income without investing in the long term success of a new crop.

Crop commercialization efforts have also failed when they were spurred by a push from a "crop champion" without sufficient demand. Although demand can typically be considered as demand for a marketplace product, there are other types of demand pull which can stimulate new crops. In some cases the demand can come from the farmers, such as for a rotation crop that can help reduce pests or soil quality problems with their traditional crops. Demand can be generated by government policy, such as through conservation or export programs. Other government demand can be created through purchasing programs, such as the recent federal effort to set up procurement incentives for biobased products.

Demand from the marketplace presumes that an alternative crop provides a product, or products, that are lower in cost, higher in quality, or superior in functionality to the products they replace. In some commercialization efforts, this "improved substitution product" has not been achieved. An example would be an alternative crop providing a livestock feed source which is equal in nutrition

[3] Webster's Third International Dictionary (1981) defines a free rider as someone who gets or tries to benefit at another's expense, or without cost to or effort by the one benefitting. The awareness of individuals acting as free riders dates back in time, as recognized by David Hume, who wrote in 1739 that "Each citizen who can enjoy the benefit of a public good has incentive to try to lay the whole burden of provision on others . . . ."

but higher in price than traditional livestock feeds.

In some cases, alternative crops have generated economically viable and promising new products, only to fail from lack of a good business plan and organizational development. An important and needed element to catalyze new crop commercialization has been the "crop champion" discussed earlier. The champion may recognize the potential benefit of a product from a new crop, and take the initial steps to gain production and entry to the marketplace. However, a lack of solid business planning may cause the supply chain to become dysfunctional, or put too much of the risk onto one set of players, such as the growers.

Identifying Characteristics of Successful New Crop Commercialization Efforts

A central focus of the workshop involved identifying which strategies or approaches can be used successfully to commercialize various new crops. Part of this discussion contrasted the "traditional" model by which new crops have been commercialized, with approaches to using some form of exclusivity. As described previously, in a traditional approach, improved varieties of a new crop are developed through public funding and made available at reasonable cost to everyone. Likewise, there are few presumed barriers to entry for processing of the crop, and thus there is the potential for a large number of players to become involved in the production of the crop. At first glance, this seems like a desirable system, especially given the public funding that would have supported the commercialization effort.

However, the wide open approach of allowing entry of all interested players into a commercialization effort has led to many of the problems described above, especially the boom-bust cycle which has derailed several promising new crops. Workshop participants agreed that in most instances, there needs to be some measure of exclusivity to the process such as:

- restricting the seed of improved or novel varieties to a certain number of growers or acres to avoid overproduction, and in some cases to maintain high quality production
- limiting processing access to a certain number of growers (and brokers)
- controlling access to markets, such as through trademarks or long-term marketing agreements

While the notion of limiting the participants in a new crop commercialization is not universally agreed upon by new crop advocates, it is an approach that may help avoid past pitfalls. A key step to success may be keeping farmers involved in the decision-making about how exclusive rights will be allocated and awarded, especially when public sector investment has been made.

With the above factors in mind, workshop participants identified several key characteristics of successful new crop commercialization models. Strategies or models for crop commercialization should:

1) allocate risks and rewards equally among participants in the production-processing-marketing chain;

2) avoid the boom-bust cycle of overproduction, market saturation, and price collapse;

3) provide supply chain management so that sufficient product is available at a time and price when buyers want it;

4) lead to products of higher quality and/or lower price than products they are replacing in the marketplace;

5) respond to demand "pulls" for the crop and/or product;

6) incorporate public-private partnerships with business and organizational plans, resulting in appropriate and sustainable roles for each partner in the commercialization effort.

The sixth point, on business and organizational planning, is expanded below.

Developing Appropriate Business and Organizational Plans

Business planning. The new crop champions who have stimulated much of the previous work on new crops have usually been a university or government scientist or a farmer. Despite great enthusiasm for a new crop, these individuals have often lacked the relevant business development expertise which could enhance potential for commercialization. The advent of university and government programs in "value-added" agriculture provide one option for assistance in developing appropriate business plans. Commercialization plans for new crops need to address several of the issues raised above, including plans for supply chain management and allocating risks and rewards to participants in commercialization.

Organizational planning. The organizational issues are even more complex than the business and marketing plans. While it is clear that successful commercialization has involved public-private sector partnerships, the most effective organizational models for achieving commercialization success are not well established.

One organizational model which has received a fair amount of attention for agricultural commercialization is "new generation cooperatives." These cooperatives, which are "closed" cooperatives that require members to invest an equity position, have taken several forms. One relevant form of new-gen cooperative is an approach where farmers invest in the construction of a processing facility, and only those investors (cooperative members) have rights to deliver the new crop to the facility. This control over processing can effectively eliminate the overproduction symptomatic of the new crop "boom-bust" cycle.

There are pitfalls in using a farm cooperative model. Farmers may not have the necessary knowledge, as a board of directors, to make decisions about processing equipment or marketing initiatives. Even where they have sufficient knowledge, the democratic process of board decision making may not be the most responsive business structure for changing marketplace conditions.

Regardless of the organizational model used, it must have participation of both public and private sector partners, as identified above. The participation of the public sector is pivotal because of the potential for objective information and tax-subsidized assistance and guidance. Given the corporate focus of our food and agriculture sector, it is essential that private sector partners be involved who can create the necessary private marketing or processing agreements, and can set up a system of allocating financial returns among participants.

Conclusions

While some new crop commercialization issues remained open to debate during the workshop, there was general agreement about the following points:

- new or alternative crops can provide much benefit to American agriculture and to society
- a number of policy, institutional, and market barriers exist to new crop commercialization
- there is a need for one or more groups to be effective advocates for new crop
- development, including through policy change and institutional support
- new crops need to contribute products of greater

value or lower cost

- sufficient demand must exist to help pull the crop into the market place
- commercialization of new crops should be based on public-private partnerships with strong farmer involvement and equitable allocation of risk and reward among participants in the commercialization process
- to avoid a boom-bust cycle of overproduction and collapsing prices, some form of exclusive participation is probably necessary in most commercialization efforts
- effective business planning and organizational development are essential to new crop success

The group was optimistic about the benefits of crop diversification, but realistic in assessing the barriers and challenges to be overcome in commercializing new crops.

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The following are examples of alternative crops that are being developed in the United States.

PEARL MILLET

Pearl millet is a warm season annual grass that is best known in the U.S. as a forage crop. Estimated U.S. area planted to pearl millet for forage use is 1.5 million acres. New varieties of pearl millet, however, are being developed for use as a grain crop. These new hybrid types of pearl millet are shorter in stature for easier combining, and higher in seed yield. Use of pearl millet grain on a commercial basis only began in the U.S. in the early 1990s, but has led to production on several thousand acres in Georgia and Florida. Most of this initial pearl millet production has been for poultry feed, although the crop shows good feed potential for other types of livestock as well. Some pearl millet has been grown for birdseed.

Although pearl millet was developed as a food crop and is still primarily used this way in Africa and India, its grain is most likely to be used for animal feed in the U.S. Several studies have been conducted on its potential for various types of animals, including poultry, ducks, cows, hogs, and catfish. In general, it performs comparably to corn in the diet for these animals, with small advantages in certain situations.

Typically the protein content of pearl millet is 45% higher than feed corn and is also 40% higher in lysine. This higher protein and other feed characteristics have helped drive the interest in the grain by poultry producers and other livestock producers. Pearl millet is much lower in tannin than sorghum and its seed is about half the weight of a sorghum seed. Seeds are pointed at one end, rounded at the other and primarily light colored with a

blue or gray tinge to them.

The main commercial market to date for grain-type pearl millet has been the broiler market. Lack of familiarity with the crop has limited its use in other livestock feed markets. However, as feed formulators and buyers become more familiar with the crop, its potential markets will expand. In the meantime, pearl millet grain can certainly be used on-farm as a feed for cows, hogs or poultry. A one-to-one substitution of pearl millet for corn in a feed formulation is usually appropriate.

CANOLA

Canola is rapidly gaining acreage as a rotation alternative with small grains and other crops. Grown in several regions of the U.S., canola has strong demand as a healthy vegetable oil. Canola's main selling point has been its low level of saturated fats, making it popular as a cooking oil and for use in processed foods. Many movie theatre chains have switched to making popcorn with canola oil instead of using imported coconut oil. This increasing acceptance of canola oil among American consumers has led to expanded production opportunities for U.S. producers, and yet the growth in acreage has not kept up with demand. U.S. production has been increasing and is now more than a million acres. In 2002, the U.S. is expected to import more than 1.5 million acres worth of canola, primarily from Canada. Canola oil has also become popular with consumers in many other parts of the globe, and export opportunities may become available.

Canola can be grown with conventional grain crop equipment, though adjustments need to be made for its small seed size. Both spring and winter (fall-planted) types of canola are available, and their patterns of production parallel the spring and winter wheat areas. Growing canola is much like growing wheat. Canola has an advantage over wheat in that it often matures earlier by a week or more. This is good for double cropping in southern states. Canola typically yields a little less than wheat, but has a higher price and sometimes a greater net profit, depending on the cost of transporting it to a buyer.

A primary limitation to

canola in some states is the current lack of in-state markets. However, the increasing popularity of canola is leading to more buyers and delivery points. Delivery points for canola currently exist in North Dakota, Minnesota, Georgia, Idaho, Colorado, Kansas and Michigan. Buyers with specialty uses of canola occasionally make purchases in additional states.

SESAME

Sesame is an ancient oilseed, first recorded as a crop in Babylon and Assyria over 4,000 years ago. The crop has since spread from the Fertile Crescent of the Ancient Near East to be grown in many parts of the world on over 5 million acres. The biggest area of production is currently believed to be India, but the crop is also grown in China, Korea, Russia, Turkey, Mexico, South America and several countries in Africa. Acreage in the U.S., primarily in Texas and southwestern states, has ranged from 10,000 to 20,000 acres in recent years; however, the U.S. imports more sesame than we grow. It would take at least 100,000 acres of sesame in the U.S. just to meet domestic demand, and production on more acres could be exported.

Sesame seeds are unusually high in oil, around 50% of the seed weight, compared to 20% seed oil in soybeans. Sesame is a high value food crop, being harvested both for whole seed used in baking, and for the cooking oil extracted from the seed. This warm season annual crop is primarily adapted to areas with long growing seasons and well drained soils. It is considered drought tolerant, but needs good soil moisture to get established.

The primary market for sesame seed in the U.S. is use in a variety of baked goods and confections. The taste of sesame differs among varieties and can be negatively affected by poor post-harvest processing and storage. Part of the attraction of sesame for baking is undoubtedly its high fat (50% oil) and high protein content (up to 25% protein by weight).

Sesame oil carries a premium relative to other cooking oils and is considered more stable than most vegetable oils due to antioxidants in the oil. After the oil is extracted from the seed, the remaining meal is a high protein material suitable for feeding to livestock. Although at this time sesame oil is used almost exclusively for human food consumption, it has potential for a variety of industrial uses, as do most vegetable oils.

SUNFLOWER

Sunflowers have a long history in the U.S., dating back at least a thousand years to when they were cultivated in fields by Native Americans. Although modern sunflower cultivars were not grown widely in the U.S. until the 1970s, there were tests of sunflower oilseed processing by the Southeast Missouri Sunflower Growers' Association in Missouri in 1926. Sunflowers are well adapted to many regions of the U.S., even though their primary production has lately been in the Northern and Western Plains. Sunflower demand has been increasing for both vegetable oil and birdseed markets.

New government policies are making it more economically favorable for sunflowers, primarily the availability of oilseed loan deficiency payments (LDPs) for sunflower. The growing size of the sunflower market, both for oilseed and birdseed uses, is creating new opportunity to add sunflowers to crop rotations. Sunflowers can be planted from April through July, including as a double crop after wheat.

Of the roughly 2.5 million acres of sunflowers that are grown each year in the U.S., up to 90% are the oilseed type. A significant fraction of the oilseed harvest goes for birdseed production, but most of the seeds are processed into vegetable oil. Of the seeds processed for oil, about equal thirds are dehulled, partially dehulled or left with hulls on for processing. When hulls are removed, they become a very low value byproduct, most often burned for fuel.

Sunflower is lower in saturated fats than most vegetable oils. The development of NuSun

varieties that are mid-level in oleic acid has spurred further interest in using sunflower oil in food preparation. NuSun oil has the primary advantage of being more stable than most vegetable oils and not needing to be hydrogenated to improve shelf life.

FLAX

Flax was one of the most important crops to early American farmers and to the economy of our emerging nation. Before the spread of the mechanical cotton gin in the early 1800s, most Americans had a choice of two clothing fibers — wool or linen. Even after the advent of inexpen-sive cotton, linen fiber from the stems of flax would remain an im-portant source of fiber for clothes and other products.

In addition to being a fiber source, flax was also an important oilseed in America until the mid-1900s. Linseed oil, squeezed out of flax seed, can still be found in most hardware stores and is used as a preservative finish on wood. Despite the valuable characteristics of both linseed oil and linen fiber, flax began to fade from American farms after the development of the petroleum industry, especially following World War II.

The renewed interest in flax has been partially based on increased demand for linen clothing, but more so because of certain healthful properties of the seed oil. Flax oil is high in omega-3 fatty acid, which is believed to be helpful in lowering cholesterol when included in the diet. This same fatty acid is found in fish, one reason that seafood is advocated for those with cholesterol problems. The high omega content of flax is playing an increased role in foods.

Flax is currently grown on about 12 million acres worldwide, with the majority of production in northern Europe and Russia. Although there were close to two million acres of flax in the U.S. as recently as the

early 1970s, U.S. acreage dropped substantially. However, acreage has been about one-half million acres, and is gradually increasing.

Flax is roughly 40% oil by weight, about 55% of which is alpha linolenic acid (also called omega-3 fatty acid). Linseed oil from flax dries rapidly, due to linolenic acid, which helps make the oil suitable for varnishes and paints that need to dry quickly. The use of linseed oil has diminished over the last 50 years, but it is still marketed widely, in places like the paints department of hardware stores.

AMARANTH

Amaranth is a broadleaf plant that could be mistaken for soybeans early in the growing season by someone driving past a field. Late in the season, however, there is no mistaking this striking, tall crop which develops brilliant colored grain heads producing thousands of tiny seeds. Amaranth was a major food of the Aztecs and earlier American cultures, having been domesticated thousands of years ago.

The attraction of the crop to both earlier civilizations and modern consumers is the highly nutritious, golden seed. Amaranth seeds are unusually high in protein for a non-legume, running around 14 to 16% protein. Even better, the protein is well balanced in amino acids, and is high in lysine, an amino acid most grains are deficient in (legumes also have high lysine).

As a food crop, amaranth not only has high protein, but high fiber as well. There may also be dietary benefits from the relatively high levels of tocotrienols in the seed. The seeds have some desirable functional characteristics, having been processed in popped, flaked, extruded, and ground flour forms.

Most of the amaranth in U.S. food products starts as a ground flour that is blended with wheat or other flours to make cereals, crackers, cookies, bread or other baked products. Most commercial products use amaranth as a minor portion of the ingredients, even if the product is touted as an amaranth product, such as “amaranth” breakfast cereal, which may be only 10 to 20% amaranth. Utilization studies have shown amaranth can often be blended at 50% or even 75% levels with other

flours in baked products without affecting functional properties or taste.

APPENDIX A

Invited Participants in Workshop on Crop Diversification Models and Strategies
held Feb. 27-28, 2003, St. Louis, MO

Ms. Carmela Bailey is a program manager with the USDA Cooperative State Research, Education, and Extension Service. She is a co-coordinator of federal efforts with biobased products, and has supervised federally-funded grants on new crops and product development.

Dr. David Baltensperger is a professor of crop science with the University of Nebraska. He has conducted plant breeding programs and coordinated extension efforts with several alternative crops in the High Plains region.

Dr. Melvin Blase* is a professor emeritus of agricultural economics at the University of Missouri. He is the lead investigator on the six-state Fund for Rural America grant which funded the workshop. He has professional expertise in commercialization of new ag products.

Dr. Dwanye Buxton is Deputy Administrator of the USDA Agricultural Research Service National Program Staff. In this role he oversees prioritization of research and development programs within ARS. He has a long-standing professional interest in new crop development.

Dr. John Gardner* is Associate Dean for Research and Outreach in the College of Agriculture, Food, and Natural Resources at the University of Missouri. In a previous position, he served as general manager of a farmer-owned new generation cooperative in North Dakota devoted to the production and processing of alternative oilseed crops.

Ms. Deanne Hackman is Division Director for Agriculture Business Development at the Missouri Department of Agriculture. She also coordinates the entrepreneurial development program with the department, and supervises efforts with value-added product development.

Mr. Andrew Hebard is General Manager of Kings Inc., and is currently based in North Carolina. He has extensive experience in the private sector side of new crop development, including in the U.K. and the European Union.

Dr. Gary Jolliff is a professor emeritus of crop science at Oregon State University. He has worked on development of meadowfoam as a new crop for many years, including development of new varieties. He has also authored several authoritative papers on new crop development.

Mr. Ray Langham is Vice-President for Research with the Sesaco Corporation. Based in Texas, in has led efforts to develop improved varieties of sesame made available to southern U.S. farmers under commercial contracts for production and processing.

Mr. Vern Mayer is a diversified grain farmer in North Dakota. A mechanical engineer by training, he has become an advocate of no-till production and diversification. He has been a member of two farmer cooperatives in North Dakota involving commercialization of crop products.

Dr. Rob Myers* is Executive Director of the Jefferson Institute, based in Columbia, MO. An agronomist who has field evaluated dozens of alternative crops, he has also worked extensively in federal policy development, including policies affecting new crops.

Mr. Steve Noack, Esq., is a partner with the Gunhus law firm in North Dakota. He is widely know for his expertise in legal issues pertaining to new generation cooperatives and other forms of business ventures dealing with new product commercialization.

Dr. Bob Quinn is an organic grain farmer in Montana. After gaining a Ph.D. in biochemistry, he returned to the family farm, where he eventually commercialized a novel type of wheat called Kamut™. He also developed a grain milling operation and has traveled extensively to food shows around the world, promoting specialty grains.

Mr. Alan Weber*, is Vice-President of MARC-IV Consulting in Missouri. He specializes in analysis and economic studies related to development of biobased products, including opportunities for commercialization and marketing of new crops.

**Member of the workshop planning committee.*