

Organic Corn for Feed or Food

Introduction

Organic field corn (*Zea mays*) destined for human consumption or animal feed is grown using production methods intended to mimic natural processes. These include a wide range of cultural practices and natural inputs, but exclude most synthetic pesticides and standard commercial fertilizers. Growers marketing their products as “organic” must be certified by a USDA-approved state or private certifying agency, which ensures the production system adheres to standards regulated by the National Organic Program (NOP).

Organic white and yellow food grade corn is produced for use in organic cereals, tortillas, corn chips, snack foods, cornmeal, and other corn-based processed products. Organic corn is also used as animal feed in organic beef, dairy, poultry, and hog production.

Marketing

In spite of the increasing demand for organic food products, organic markets can be more difficult to locate than conventional ones. Unlike conventional growers who have the option of selling their grain on the open market, organic growers usually must contract with buyers prior to production. Grain storage facilities could also provide a marketing advantage by allowing growers to sell when prices are strong.

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Organic feed corn can be grown for on-farm use and/or off-farm sales. Unprocessed corn could be sold under contract to feed mills, manufacturers, or brokers. Another option is to sell corn directly to organic livestock producers.

Market Outlook

The demand for organic food products has increased, a trend expected to continue as organic food products become mainstreamed into major grocery chains. In addition, the steady growth of organic meat and poultry markets should mean increasing opportunities for organic feed grain sales. The lack of organic corn production in Kentucky could present a potential market opportunity for Kentucky corn producers.

Organic feed grain markets may be easier to identify and more accessible than those for organic food corn. In addition, the quality specifications for animal feed are less stringent than for corn destined for human consumption. Maintaining a quality crop from beginning

of production through market is of the utmost importance in food corn. Growers new to organic farming may find organic feed production is less exacting and perhaps less risky than food corn production. It is important to note, however, that maintaining the integrity of organic corn ‘from-seed-to-market’ is critical regardless of the intended end use.

As with any niche market, prospective organic corn growers should identify a viable market before investing in a new enterprise. Contracts should clearly state the specific corn cultivars desired, quality standards, quantity expected, and whether the grain is to be cleaned, processed, bagged, and/or stored prior to delivery or pick-up.

Production Considerations

Seed and variety selection

Field corn for food and feed are dent corn hybrids with specific starch traits. Organic production requires the use of certified organically produced seed, if it is available. No seed may be treated with synthetic chemicals, and genetically modified hybrids (GMOs), such as ‘Bt’ or ‘Roundup Ready’ corn, are strictly prohibited.

Select locally adapted cultivars with qualities demanded by the intended market. It is especially important for organic producers to choose varieties with resistance to as many common disease and insect problems as possible. Other key desirable features include good standability, stress tolerance, suitable days to maturity, and yield. For University of Kentucky statewide variety trial research data, refer to the KY Statewide Trials page on the Department of Plant and Soil Sciences Grain Crops Extension Web site (see Selected Resources). When grown under contract, the processor generally specifies the hybrids to be planted.

Site selection

Only land that has been free of prohibited substances (e.g. synthetic pesticides and artificial fertilizers) for 3 years can be certified for organic

production. Selecting a growing site that is well-suited to the crop is especially important when utilizing organic methods. Healthy, fast growing plants are better able to tolerate or outgrow pest problems.

Corn does well on a wide variety of soils, but performs best on silt loam soils that are well drained, in good tilth, and free from erosion. Stay away from fields where aggressive perennial weeds have a history of being difficult to manage, as well as sites known to harbor serious long-term disease pathogens. Droughty soils should also be avoided.

Land preparation and fertility

Crop rotations designed to increase soil fertility and reduce weed pressure are a critical aspect of site preparation. Healthy soil is the key to successful organic production. Well-planned rotations and soil-building cover crops are needed to replenish the soil between corn crops. Soil fertility is also enhanced through composts, green manure, properly aged animal manure, and approved natural fertilizers. Rotations have the additional benefits of improving plant health, disrupting insect and disease cycles, and enhancing biodiversity.

NOP regulations require that all cover crops planted in a certified organic field must be grown from organic seed, if it is available. While cover crops of grasses will increase organic matter, nitrogen-fixing legumes have the additional benefit of adding nitrogen. A healthy forage legume cover crop that has been incorporated into the soil prior to the cash crop can supply a large portion of its nitrogen needs. While non-forage legumes, such as soybeans, may be moderate nitrogen fixers, little of it is returned to the soil for subsequent crops. Supplemental organic nutrient sources include bloodmeal, fishmeal, cottonseed meal, and soybean meal.

Tillage systems and planting

Reduced tillage systems, particularly no-till, are the dominant seeding techniques used for

conventional corn in Kentucky. Because no-till generally relies heavily on herbicides for weed and cover crop control, traditional tillage systems are often used in organic production. However, mowing, undercutting, or rolling has been shown to be an effective replacement for herbicides. A recent University of Kentucky research project involved successfully rolling down weeds with a front mounted roller crimper. Researchers concluded from this study that no-till methods do have potential in organic corn production. No-till is best suited to soils that are moderately well-drained to well-drained.

Growers using traditional tillage techniques need to incorporate the cover crop 2 to 3 weeks in advance of planting to allow time for decomposition. This major tillage operation should be followed by lighter tilling to create a smooth, weed-free seedbed prior to planting.

Optimum planting dates usually range from the first of April to mid-May in Kentucky. Early planted corn has fewer disease and insect problems, and generally out-yields late-planted corn. On the other hand, late planting can result in faster emergence and may be more compatible with no-till systems.

Seed depth can be a critical factor in organic systems. Seed planted too deeply will be slower to emerge and may result in damping-off problems. In addition, delays in emergence may mean plants face greater weed competition.

Seeding rates, which depend on the tillage system (conventional or no-till) and use (food, silage, or grain), are generally higher in organic production. Higher plant populations tend to out-compete weeds more effectively. In addition, the canopy closes more quickly in narrow-spaced rows, reducing light penetration to the ground, and thereby inhibiting weed germination. These benefits must be weighed against the greater potential for disease and insect pests as well as machinery costs associated with narrower rows.

Since corn hybrids readily cross-pollinate, it will be necessary to isolate different cultivars from each other to prevent unwanted crosses. In addition, growers will need to take steps to prevent pollen drift and contamination from GMO varieties that may be present in neighboring fields. The presence of even low levels of GMO corn can jeopardize the marketability of the crop since contaminated corn cannot be sold as 'certified organic.' Isolation of cultivars can be accomplished by physical separation or by making sure there is a minimum of 14 days difference in their maturities.

Growers with split operations (organic and conventional production on the same farm) must take additional steps to prevent the commingling of their two systems. The integrity of organic grain must be maintained through all stages of production, harvest, storage, and transportation. Shared equipment and storage facilities must be decontaminated before use with organic crops. The drift and run-off of prohibited substances, such as pesticides, from conventional farms can also compromise the crop's organic certification status. Preventative strategies include the use of buffer zones and barriers, altering drainage patterns, posting "no spray" signs, and cooperating with neighboring conventional farmers.

Pest management

Organic corn production can be challenging in Kentucky due to the number of disease and insect problems that can reduce harvest quality and yields. Pest management in organic production emphasizes prevention through good production and cultural methods. The goal is not necessarily the complete elimination of a pest, but rather to manage pests and diseases to keep crop damage within acceptable economic levels.

Common pest management practices include crop rotation, removal or incorporation of crop residues, use of resistant cultivars, timely planting, and avoidance of stresses due to poor fertility, improper soil pH, or inadequate moisture.

Organic growers use a range of Integrated Pest Management (IPM) practices, including regular field scouting. Frequent crop inspections are essential to keeping ahead of potential problems; monitoring pests requires accurate identification.

Corn earworm is one of the most destructive insects attacking corn. Properly timed sprays with an organically approved insecticide, such as Bt, is the most effective way to combat both this insect and the European corn borer. Baits of Bt with corn meal or bran with molasses may be effective for reducing cutworm damage. Other insect pests that can cause crop damage include armyworm, Japanese beetles, and flea beetles. Variety selection, adjusting planting dates, controlling nearby vegetation, beneficial insects and predators, sanitation, and crop rotation are additional organically approved pest management strategies. Pheromone and/or black light traps are useful for monitoring pest populations. Some management techniques may be more economically feasible with high value specialty corn.

Common disease problems include seed rots/seedling blights, Stewart's wilt, leaf blights, gray leaf spot, rust, stalk rots, and viruses. Key disease management practices in an organic system include crop rotation, the use of resistant varieties, providing adequate fertility, and sanitation. Historically, white corn hybrids are not as resistant to foliar diseases as yellow corn hybrids.

The main challenge to organic growers, however, is often weed control. If left unchecked, weeds compete with plants for water and nutrients, harbor insect and disease pests, and reduce air circulation. Since synthetic herbicides cannot be used, organic growers will need to manage weeds with alternative methods. An important first step is to avoid planting in sites with high noxious perennial weed populations. Along with site selection, site preparation should be aimed at making sure existing weeds are under control. Managing weeds during the first 4 to

6 weeks after planting is particularly critical to maintaining high crop yields. Cultivation, propane torches or flame weeders, and mowing are methods of reducing weed problems during the growing season.

Harvest and storage

Harvest equipment, storage areas, and packaging materials must comply with NOP standards. This is also true of processing areas and mills. Growers with split operations must either use separate equipment and facilities for each production system or decontamination protocol must be followed before use in the organic end of the enterprise. Additionally, producers who share harvest equipment with neighboring farms or who hire custom operators must be diligent in preventing commingling of organic and non-organic grains. Packaging materials must be protected against potential contamination from prohibited substances.

Harvest should begin when operators can optimize profits. Factors such as the price of the corn; potential yield; length of harvest period; weather; and costs of equipment, labor, and energy can all influence harvest.

Where the possibility of cross pollination with GMO crops exist, it is often advisable to harvest the outer edges of the field first and market it as conventional grain. This can reduce the risk of contaminating the organic grain with accidental GMO cultivar crosses. Since combines can hold several bushels of grain from the previous harvest, diligent cleaning of harvest equipment is crucial when switching from conventional to organic. Organic grains contaminated with GMOs can result in the rejection of the entire load.

Harvesting with a rotary combine generally results in less damage to the kernels. Quality kernels should be low in stress cracks and have low moisture content. Harvested grains must be undamaged and free of weed seed, mycotoxins, and other contaminants, as well as free of GMOs. Aeration is necessary for extended storage.

When the kernels reach black-layer (also known as physiological maturity) corn kernels are at about 30% to 35% moisture. Harvesting corn for grain usually occurs after the kernel moisture is below 25%. Kernels need to be dried to 16% moisture within 24 hours after harvest and should be cooled to outside air temperatures within 48 hours after harvest for safe storage. Field-drying is best; however, the kernels may be machine dried at low temperatures.

Processing grains can involve cleaning, conditioning, milling, extrusion, and/or bagging. Processing areas and bagging materials must be protected against potential contamination from prohibited substances and commingling with conventional grains.

Labor requirements

About 25% more labor is required for organic grain production than for conventional; expect about 2 to 2½ hours per acre. Small farms tend to use more labor per acre than large farms.

Economic Considerations

Initial investments include land preparation (including cover crop seeding), purchase of seed, and organic fertilizers. Total pre-harvest variable costs per acre of corn may fall in the \$175 to \$235 range per acre, with harvest and marketing costs adding an additional \$65 to \$100 per acre. Harvest, handling, and marketing costs may be greater for organic food corn depending on distance to market and the farm's harvest and handling facilities.

Total 2010 costs for organic field corn (for feed) were estimated at \$358 per acre. Presuming a harvest of 100 bushels sold at \$6 per bushel, gross returns would equal \$600 per acre. Returns to operator labor, land, capital and management would be approximately \$242 per acre. Corn produced for food has historically sold at a premium over feed corn, but such premiums could decline in the face of higher commodity prices during 2010 to 2011.

Selected Resources

- Comprehensive Guide to Corn Management, ID-139 (University of Kentucky, 2001)
<http://www.ca.uky.edu/agc/pubs/id/id139/id139.htm>
- Corn and Soybean Budgets (University of Kentucky, 2011)
[http://www.ca.uky.edu/cmcpubsclass/tiny_mce/jscripts/tiny_mce/plugins/filemanager/files/ghalich/Corn%20and%20Soybean%20Budgets%20\(Kentucky%202009\).xls](http://www.ca.uky.edu/cmcpubsclass/tiny_mce/jscripts/tiny_mce/plugins/filemanager/files/ghalich/Corn%20and%20Soybean%20Budgets%20(Kentucky%202009).xls)
- Grain Crops Extension: Corn (University of Kentucky)
<http://www.uky.edu/Ag/GrainCrops/corn.htm>
- Integrated Crop Management Manual for Corn (University of Kentucky, 2009)
<http://www.uky.edu/Ag/IPM/manuals/ipm2corn.pdf>
- KDA Division of Value-added Plant Production: Organic Program (Kentucky Department of Agriculture)
<http://www.kyagr.com/marketing/plantmktg/organic/index.htm>
- KY Statewide Trials (University of Kentucky Grain Crops Extension)
<http://www.uky.edu/Ag/GrainCrops/varietytesting.htm>
- Marketing Organic Grains (Midwest Organic and Sustainable Education Service, 2009)
<http://www.mosesorganic.org/attachments/productioninfo/fsgrains.pdf>
- National Organic Program (USDA-AMS)
<http://www.ams.usda.gov/nop>
- Organic Corn Budget (North Carolina State University, 2007)
<http://www.organicgrains.ncsu.edu/cropproduction/Cornorganic.pdf>
- Organic Corn Production Budget: Conventional Tillage Practices (Ohio State University, 2009)
<http://aede.ag.ohio-state.edu/Programs/FarmManagement/Budgets/crops-2009/corn-organic-2009.pdf>

- Organic Crop Production Enterprise Budgets (Iowa State University, 2011)
<http://www.extension.iastate.edu/agdm/crops/html/a1-18.html>
- Organic Feed-grain Markets: Considerations for Potential Virginia Producers (Virginia Tech, 2009)
<http://pubs.ext.vt.edu/448/448-520/448-520.html>
- Organic Field Corn Production (ATTRA, 2002)
<https://attra.ncat.org/attra-pub/summaries/summary.php?pub=90>
- Organic Grain Production Guide (North Carolina State University, 2005)
<http://www.organicgrains.ncsu.edu/cropproduction/Production%20Guide/tableofcontents.htm>
- Organic Weed Control Toolbox (eXtension, 2010)
<http://www.extension.org/article/18532>
- Overview of Cover Crops and Green Manures (ATTRA, 2003)
<https://attra.ncat.org/attra-pub/summaries/summary.php?pub=288>
- Profitability of Transitioning to Organic Grain Crops in Indiana (Purdue University, 2010)
<http://www.agecon.purdue.edu/extension/pubs/paer/2010/february/alexander.asp>
- Protecting the Integrity of Organic Grains During Harvest (Rodale Institute, 2004)
<http://newfarm.rodaleinstitute.org/columns/inspector/2004/0804/081704.shtml>

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