FIELD EQUIPMENT CLEAN-OUT FOR IDENTITY-PRESERVED GRAIN PRODUCTION

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Introduction

As many growers move toward specialty or value added crops, some are interested in segregating grain production by seed varieties or hi-breds within grain genetics, rather than by grain types (e. g. corn, soybeans, oats). Consumer demand is driving the emergence of these value-added markets. Initial efforts have focused on developing a framework to segregate genetically modified (GMO) grain from non-GMO grain for export sale. Both traditional plant breeding and biotechnology are creating an ever-increasing array of products that require specialized management to segregate, maintain, preserve and market the trait's value. Corn and soybeans carrying genes for antibiotics and industrial chemicals are being introduced and will rapidly increase over the next 3-5 years. One estimate is that there will be more than 400 pharmaceuticals produced through plants within the decade. Such products, unlike the commodity grain produced today, require segregation to take advantage of the special genetically imparted traits.

The well-publicized problems with StarLink™ corn demonstrated the commodity system's current difficulties in completely segregating corn for food and feed, costing food companies hundreds of millions of dollars in products and brand equity. The advent of additional genetically modified grains will increasingly require that value chains adjust to customer needs (including food safety concerns), thus creating new premium grain markets that U.S. grain producers can potentially capture. Consumers are creating additional demand for identity-preserved processed grain products beyond simply non-GMO products (e.g. demand for organic production, processing and labeling).

Such growth of new specialized grain products puts a focus on the need for field machinery sanitation. For those producers delivering segregated grain to market, an important initial question to ask is what level of grain purity is required in the amount to be subsequently marketed?

On-farm sources that can dilute the purity of grain delivered for processing include leftover grain in planters, combines, grain augers, and bins, and cross-pollination of corn hybrids. Before setting maximum allowable seed contamination from any single source, recall that contamination from some sources such as isolation of corn fields (cross-pollination) or the many nooks and crannies in a combine may be more difficult to control or predict than contamination from other sources such as grain handling and storage equipment, and the planter. Contaminated corn seed dropped by the planter can generate additional contamination later in the season by cross-pollination. Although a goal of 1% total contamination may be relatively easy to attain for any single piece of equipment alone, because co-mingling of grain from several sources is cumulative it's desirable to strive for much smaller contamination from individual pieces of equipment. For example because the planter is relatively easy to open and clean and foreign corn seed has the potential to cross pollinate and multiply, a much lower goal of 0.1% contamination may be desirable. Because of its size and the numerous areas where small amounts of grain can accumulate inside the machine, the combine presents perhaps the most difficult challenge of field equipment to maintain grain purity. Its maximum contamination level should still be considerably less than the total goal to avoid problems.

Planter

If "all" undesirable seed must be removed from the planter, then the planter should be disassembled as much as practical without affecting calibration, and seeds removed during a thorough inspection. If, however, a small percentage of undesirable seed can be tolerated the operator may adjust cleanout procedures accordingly.

For a given accepted tolerance, a lesser number of undesirable seeds per 1000 feet of row is allowed at lower seeding rates. For example in 30-inch rows 0.1% of undesirable seeds equals just two seeds/1000 ft of row at 35,000 seeds/acre but ten seeds/1000 ft of row at a seeding rate of 175,000 seeds/acre. Thus one corn seed left in a planter row unit may represent a contamination level equivalent to five soybean seeds in wide rows.

Of particular concern is a small number of seeds that may "hang-up" somewhere in or on the row unit or planter and later drop in a short length of row at some random time. Although the chance of this occurring is probably not great, it is possible. In other words, it is not only how many undesirable seeds are left in/on a row unit, but how quickly they exit (e.g. if a buffer area is used) or if they exit individually over a long distance or as a concentrated group at some unknown time and location.

Limited testing of planter cleanout at the Iowa State University Agricultural Engineering Research Farm using finger mechanism (John Deere & Kinze), CaseIH central seed hopper, CaseIH 1200, brush mechanism (Kinze & John Deere), White air, John Deere vacuum, and grain drill metering units indicates that specific clean-out recommendations depend on style of the planter and seed-metering mechanism. Planter operators currently doing a conscientious job of removing visible seed when changing varieties probably have seed drop contamination levels below 1% within 1000 feet of operation (20 seeds/1000 ft of row at 35,000 seeds/acre or 100 seeds/1000 ft of row at 175,000 seeds/acre; assumes 30-inch rows). However, because it is impossible to determine just when several seeds caught inside a row unit may finally drop,

contamination may occur at unpredictable locations in the field unless care is used to thoroughly clean the planter.

For specific procedures for individual planters, operators are referred to their operation manual, ISU Extension bulletins PM 1902 – PM 1908, and ISU Extension video "Planter Clean-out Procedures for Corn and Soybeans" listed in the references. Unless cleaning in a field that was just planted with that seed, use tarps in addition to seed containers to gather and contain seed that's removed. Rubber gloves are needed to handle treated seed. Leather gloves and a hard hat will protect against abrasions on steel surfaces. Eye protection is needed for cleaning with compressed air. After careful cleaning and inspection in the seed hopper and metering area, be sure to inspect the planter frame, particularly near the seed drop tube, double-disc seed openers, depth wheels, and press wheels. Seed may have fallen during cleanout, earlier seed filling, or may be sticking to planter components if soil is moist or seed openers dirty. Experience with an individual planter over time will help to find common areas where seed may be lodged. If tolerances are low, you may wish to plant a buffer area before planting an area that will be harvested for another variety.

Combine

The combine is a primary source of on-farm grain co-mingling due to its complexity and the difficulty in completely cleaning out the machine. The traditional operator practice of emptying the combine by operating the clean grain auger until "empty" leaves 60 to 120 pounds of grain or more in the machine. Two bushels of unwanted grain randomly co-mingled into subsequent product harvested represents an impurity level of 0.1% in 2,000 bushels. Because final product impurity is cumulative from all sources (seed, planter, pollination, handling, processing) this level can be excessive for some markets.

Few measurements of the amount of grain remaining in a combine after field emptying have been reported. In a study on management techniques to control insect infestation in wheat Quick (1977) found 92 lb of wheat and crop residue in an Australian pull-type combine. Greenlees and Shouse (2000) found 59 lb of corn residue in a John Deere 4420 combine. In October 2001, we removed 120 lb of corn grain and residue from a larger John Deere 9400 combine at Iowa State University's Southeast Research Farm after the unloading auger had run empty for one minute.

Clean-out procedures for an individual combine depend on the make and model. Operators should consult the operation manual. General procedures are given in Pm-1923, Combine Clean-out Procedures for Identity-Preserved Corn and Soybeans and a videotape, Combine Clean-Out Procedures for Identity-Preserved Grain, listed in the references. Consider the level of purity desired to help decide if some components (e. g. the chaffer and sieve) need to be removed for cleaning. As with the planter, choose a location for cleaning and gather safety gear. Because compressed air, shop vacuum, and/or a leaf blower will probably be used dust masks are required as well as power from a portable generator or at the farm shop. If the combine is not cleaned in the field just harvested, it may be desirable to use collection tarps to avoid further spread of unwanted seed.

Systematically clean the combine from front-to-back and top-to-bottom spending time in each area of the combine. Areas include the gathering head, feederhouse, rock trap, clean grain tank, rotor/cylinder and separating area, cleaning shoe, chopper/spreader, and rear axle. If the combine is started with some access doors open after all grain that can be reached is physically removed, make sure everyone is away from the machine. Avoid temptation to be near access openings and do any cleaning with power engaged and the engine operating. Make sure all safety shields, doors, and openings are closed and fastened after cleaning.

Conclusion

Preserving grain identity for individual traits such as starch, oil, protein, or fiber content or from organic production techniques are increasingly important as customer demand races ahead of current field production techniques. Producers will want to carefully evaluate the level of grain or oilseed purity required in developing efficient clean-out techniques for equipment. Desired purity will become associated with different market premiums. Potential rewards for several hours of cleaning are significant. A product premium to the grower of $0.50/bu on a soybean crop yielding 40 bu/a on 500 acres is $10,000 added to an individual farmer's annual profit.

References

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