Development of a Cover Crop Inter-Seeder and Applicator for No-till Corn

PENNSTATE College of Agricultural Sciences

Corey Dillon, Gregory Roth, William Curran, and Christian Houser
Plant Science Department, The Pennsylvania State University, University Park, PA

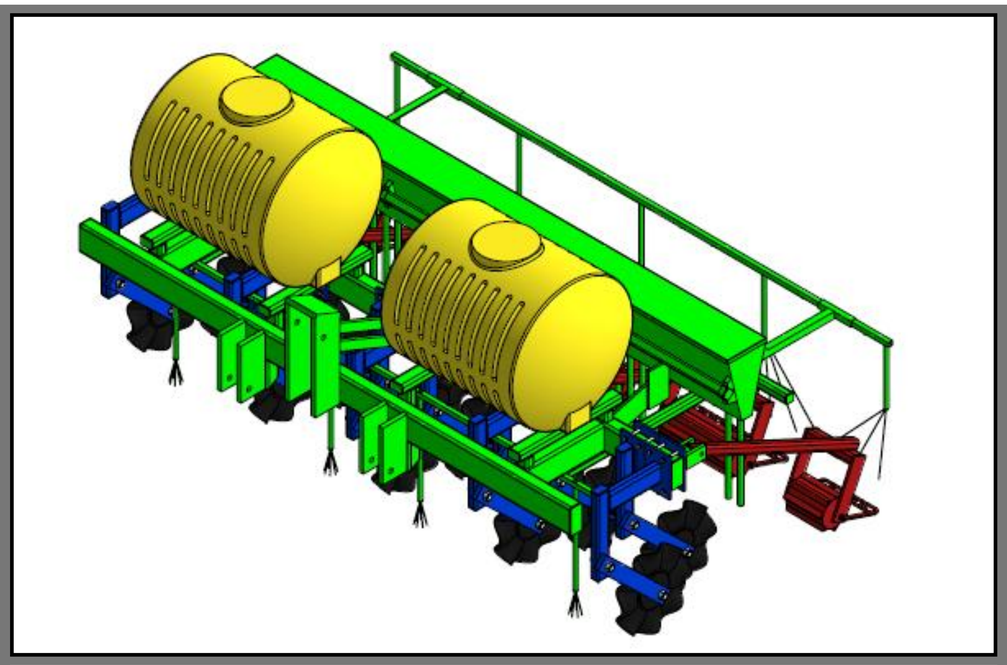
PENNSTATE Cooperative Extension College of Agricultural Sciences

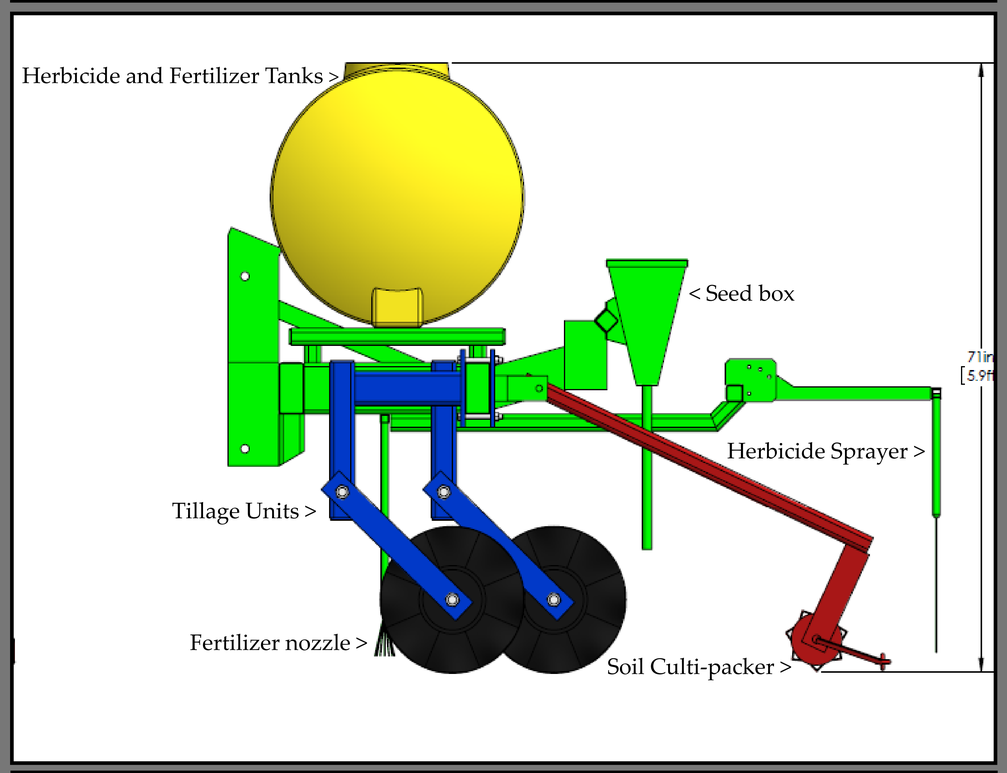
Background

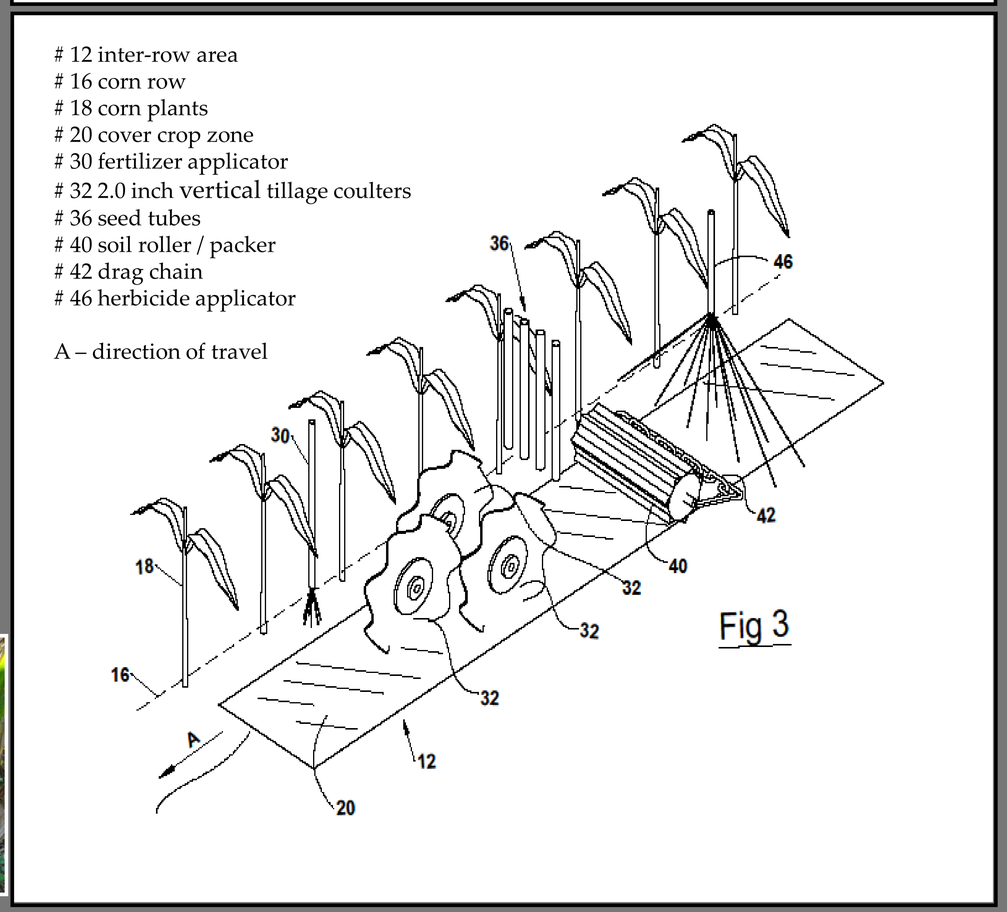
Cover crops have limited opportunity to establish after the fall grain harvest in corn or soybeans due to several factors. Time constraints of the harvest and lack of positive weather conditions many times prevents the adoption of cover crops. These constraints, along with the economic impact of additional costs in both cover crops seed and the more field operations, results in a lack of appreciation for the use of cover crops and the many benefits associated with them. In the past when farmers cultivated row crops such as corn or soybeans, it was not uncommon to broadcast a grass or legume seed into the cash crop at the last cultivation. A Penn State publication from 1947 (Efficient Corn Growing Circular 305, Feb 1947 Ag Extension Service) talks in length about this practice. In a sense, farmers were seeding a cover crop in mid-summer rather than after harvest. Today this concept is known as relay cropping or inter-cropping, where a cover crop can be grown in conjunction with the primary cash crop.

Objectives

The overall objectives of this study were to design and test a cover crop seeder with applicators that could till and seed a cover crop within the inter-row area of corn or soybean, apply precision fertilizer and post-emergence herbicide in one operation with the unit. Our hypotheses were - 1. it is possible to establish an acceptable stand of cover crops into growing fields of corn or soybeans in the early growing season as opposed to after grain harvest; 2. the unit could successfully operate in a no-tillage environment where hard soil and heavy crop residue would be present; 3. the inter-seeder would only till the soil up to 3.81 – 5.08 centimeters deep so that it would not diminish the benefits of a no-till soil structure; 4. the inter-seeded cover crop would not have a negative impact on corn or soybean grain yield.







Materials and Methods

Experiments were conducted during 2010, 2011, and 2012 at the Russell E. Larson Agricultural Research Farm near State College, PA, as well as several "on farm" locations with farmer cooperators throughout Pennsylvania. A prototype seeder was designed and constructed at the Research Farm. The seeder is constructed around the parameters of a 76.2 cm primary crop row spacing with the height of the primary crop not exceeding 71.12 cm. The design consists of three tillage units operating within the inter-row space of the primary crop. The units use a two inch wide wavy coulter spaced 20.32 cm apart creating a 40.64 cm tilled zone. The unit utilizes a gate opening seed box which distributes seeds onto the tilled zone just behind the tillage units. A culti-packer soil roller and drag chain then follows just behind the dropped seeds incorporating them into the soil. The fertilizer applicator is located on the front of the unit with the fertilizer injectors spaced four inches off the corn row using a high pressure nozzle to inject liquid nitrogen fertilizer. The herbicide applicator is located on the rear of the unit with drop tubes using TeeJet (TT11005) nozzles applying the herbicide under the corn canopy onto the target weed species.

Results

In 2010, initial results were very positive from studies conducted at the Research Farm. The seeder worked well in a no-tillage environment and established acceptable cover crop stands in corn no-till planted into corn or soybean residue. In 2011, larger on farm testing was conducted at several sites throughout Pennsylvania with acceptable cover crop stands established. In the winter and spring of 2012, three inter-seeders were constructed and distributed to farmer cooperators for larger field experiments. The inter-seeders have planted at over 35 field sites in Vermont, Pennsylvania, and Maryland. In April of 2012, Penn State University filed a patent application with The United States Patent Office for the development of the Penn State Inter-seeder U.S. Patent Appl. 13/443,339; PSU 2010-3730 (Roth, et al.). In August of 2012, a Conservation Innovation Grant from the USDA was awarded for further testing of another five inter-seeders at Cornell University, USDA Beltsville Maryland, and Penn State University. For more information contact Corey Dillon at csd109@psu.edu or watch a YouTube video at http://www.youtube.com/watch?v=Pi0zbO61DgA