Introducing CoverCress™, The Cash Cover Crop

CoverCress Inc. is introducing a brand-new, renewable oilseed and animal feed meal crop that is being developed mainly for alternative biofuels and labeled as CoverCress™ varieties. As a winter annual, it requires cooler weather, making it an ideal crop to plant during or after corn or soybean harvest in the fall. It forms a rosette in the fall, vernalizes during the winter, and bolts and flowers in early spring. It is then harvested mid-spring in the US Corn Belt just ahead of the next summer’s crop planting. Overall, this new crop is sustainable and fits into existing crop rotations in the Midwest.

With a composition of 30-35% oil, CoverCress grain is remarkably similar to canola, thus making it an excellent choice for alternative biofuels. Eventually, it will be food-certified like canola. In addition, the seed meal that these varieties produce is 35-40% protein with a low fiber content. The elevated levels of oil and protein content produced along with the low fiber consistency allow CoverCress meal to be an ideal component of feed diets for poultry, beef, and pork in either whole-form seed or as press cake after oil crush. Both feed forms are currently under evaluation in the feed industry.

Besides potential additional revenue from grain production, this crop also provides several cover crop benefits like capturing nutrients from the previous crop. In doing so, it requires relatively little additional fertilizer, which results in an exceptionally low carbon intensity score. CoverCress plants also provide the environmental benefits of helping improve soil quality through recycling deeper soil nutrients, reducing erosion, and adding diversity to the crop rotation, which in turn helps with weed and disease control.

Visit our website at www.covercress.com if you want to learn more, and while you’re there, sign up if you’re interested in becoming a grower of this new, multi-beneficial crop!
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Chapter 1: Adding a CoverCress™ Crop Delivers Three Crops in Two Years

The introduction of the CoverCress crop into a typical corn and soybean crop rotation will allow for three harvestable crops in two years. Growers can plant CoverCress seed after early-harvested corn or early-harvested soybeans and harvest it before planting soybeans or corn the following spring.

The CoverCress cropping system will use land that would otherwise be idle six to eight months each year. This additional crop will capture unused nutrients, protect soil integrity, and capture carbon while minimally impacting current cropping programs.

Growers who plan to plant a CoverCress crop after corn should limit their applications of HPPD-inhibiting herbicides to pre-emergence applications only or use no HPPD-inhibiting herbicides at all in their corn herbicide program. See Chapter 3.1 – Herbicide Programs for more details on HPPD-inhibiting herbicides and field selection.

Below are two cropping rotation models showing how this addition delivers three crops in two years.

**Model 1**

1. Harvest corn in early to late September.
2. Plant CoverCress seed immediately following harvest.
3. Harvest CoverCress grain May 20th – May 30th.
4. Immediately plant soybeans.

**Model 2**

1. Harvest soybeans in early to late September.
2. Plant CoverCress seed immediately following harvest.
3. Harvest CoverCress grain May 20th – May 30th.
4. Immediately plant corn.
Chapter 2: CoverCress™ Background and Origins

Field Pennycress History

Field pennycress (FPC) was originally identified as an interesting potential oilseed crop in the 1940s. Since one of the major components of FPC oil is erucic acid, an important fatty acid in industrial applications, FPC re-emerged as a potential source of this erucic acid during the early 1990s. Later, in the early 2000s, FPC was investigated for use as a potential soil fumigant to replace methyl bromide in high-value crops due to the inherent glucosinolate content in its seed. Neither of these concepts was fully developed.

When the biodiesel industry began fast expansion in the mid-2000s, this caused the associated “food versus fuel” debate with respect to fuel uses for soybeans and corn. At this point, the USDA decided to re-investigate FPC as a potential oilseed source for fuel production. This idea was valid in the “food versus fuel” debate because FPC is a winter annual plant that would be grown on otherwise fallow ground during late fall, winter, and early spring months.

Early background work on FPC was done by the USDA, Western Illinois University, Illinois State University, and another initial commercial partner. In 2013, Arvegenix, Inc., now known as CoverCress Inc., formed to attempt to commercially develop a domesticated version of FPC as a new crop, which is under the brand name CoverCress™.

Figure 1: Collection points for native pennycress collections by Western Illinois University and CoverCress Inc.
As Figure 1 above demonstrates, native pennycress was collected all across the US by researchers to be studied for potential cultivation as a crop to fit into the existing corn and soybean rotation in the US Corn Belt. Researchers noted that this plant matured much earlier than the other native plants surrounding it. This earliness of maturation was a critical selection trait for the development of this new crop because it meant that it was harvestable before the following summer crop would be planted.

Since these plants have been collected, much time and effort has gone into breeding and gene editing the wild type varieties to dial in on the domesticated versions known as CoverCress™ varieties, which will begin launching commercially in the fall of 2022.

Photo 1: Native pennycress in an open lot in Chesterfield, Missouri, in early spring. Note that while most of the surrounding plants are still green, the pennycress is yellow, which is a sign of maturation.

Photo 2: Field of pennycress in early spring at pod fill stage.

Photo 3: Dark-colored, wild-type field pennycress seed (left) and light-colored CoverCress seed (right).
Chapter 3: Detailed Crop Management Recommendations

This chapter outlines the best practices for crop management known to promote the successful growing of the CoverCress™ crop. If at any point a question arises regarding any of these practices, contact CoverCress Inc. for clarification.

3.1 Field Selection

In general, CoverCress seed establishes and grows effectively when planted on a wide range of soil types and soil conditions. Even so, the following factors should be considered when planning where to grow this crop to ensure a high probability of its success.

- Herbicide Programs
- Field Drainage
- Slope of Field
- Weed Control

Herbicide Programs

When planting a CoverCress crop after corn, carefully consider the corn herbicide program before planting the corn. Common herbicides used in corn production are Group 27 HPPD-inhibiting herbicides, which can be detected in the soil beyond corn harvest. The length of time these herbicides can reside in the soil depends on weather conditions, soil organic matter, and soil texture. The mode of action in this group of herbicides has been shown to negatively impact CoverCress plants as they are growing and would impact yield if damage is significant enough.

It is recommended that growers who plan to plant this crop after corn limit their applications of HPPD-inhibiting herbicides to pre-emergence applications only or use no HPPD-inhibiting herbicides at all in their corn herbicide program. Figure 2 below contains a list of common herbicides in this group, but if a grower is unsure of the mode of action of an herbicide in their program, they should contact their herbicide dealer.

![Figure 2: Common HPPD-Inhibiting Herbicides](source: University of Wisconsin-Extension, College of Agricultural and Life Sciences)
**Field Drainage**

The drainage of a field can have direct impact on the success of your CoverCress crop, so it is imperative to select fields with good drainage. The plants, which establish in the fall as rosettes, will tolerate typical wet winter soils, but they do not respond well to excessive ponding. In very wet soils, these young plants can be susceptible to heaving during the winter months much the same as alfalfa. Fungal pathogens that negatively affect CoverCress plants also become a problem in improperly drained soils.

**Slope of Field**

When choosing a favorable field, pay attention to field slopes. If planting CoverCress seed in fields with slopes of greater than 5%, previous crop residue cover of 50% or greater is recommended to prevent the seed from washing down the grade in heavy rain before establishment.

**Weed Control**

Weed control is also a crucial factor when selecting the proper field to grow your CoverCress crop. Currently, there are no defined weed control herbicide programs for the CoverCress varieties. Thus, select fields with historically good weed control and that are relatively weed-free prior to planting to help with stand establishment. Winter annual weeds such as henbit, purple dead nettle, chickweed, and shepherd’s purse are fierce competition for the crop, so it is recommended that you steer away from planting in fields that these or other known winter annual weeds are already problematic.
3.2 Seeding Recommendations

Seedbed Preparation

CoverCress™ seed will establish under a broad range of seedbed conditions. The most effective method for reliable stand establishment is when there is some light disturbance of the soil surface and chopping of the crop residue such that residue is distributed evenly and pinned close to the soil surface.

Tillage tools like a vertical tillage disk, light tandem disk, or diamond disk harrow all work well to break up the soil surface and size up the residue left on the surface. Many of these tools can also be outfitted with an air seeder to seed in the same pass of tillage. CoverCress seedlings thrive very well when there is adequate crop residue on the soil surface with 50-75% residue coverage being ideal. Corn residue (more so than soybean residue) also provides a good way to preserve the top layer of soil moisture, but both residues prevent seed movement in seeded areas during heavy rains or wind.

Aerial applications of CoverCress seed can be applied within a week before corn harvest if a chopping corn head is used with no tillage following the corn harvest. In this case, corn stalks should be cut as close to the soil surface as possible with residue chopped as finely as possible. Aerial application has not been fully tested in standing soybeans as of this publication.

CoverCress seed can also be planted with a combine seeder at corn or soybean harvest. It is recommended that the seed be dropped ahead of the chaffer so it is placed as close to the soil surface as possible and the residue can provide a mulch layer to capture moisture and aid in germination.

Clean tillage followed by surface planting may be used but often may not provide enough moisture retention for reliable establishment. Clean tillage also reduces protection for overwintering of the small rosette seedlings. Surface residue also aids to protect the soil and reduces soil erosion and nutrient loss.
CoverCress seed is tiny (roughly 1 mm in diameter) and requires adequate light to germinate, so avoid deep seed placement with a drill or other planting implement. Its progenitor, field pennycress, is defined as a weed of disturbed soils, and placing the seed too deep limits light availability for uniform germination and stand establishment.
Seeding

Ideally, CoverCress seed should be planted as soon as possible post-harvest of the preceding corn or soybean crop. The optimal planting window is early September to no later than October 10th for our southern-most launch geography. Earlier stand establishment in the fall takes advantage of moisture and light interception which pushes an earlier harvest in the spring.

Very shallow to surface seeding at 5 lbs./ac in lightly disturbed soil is recommended. Seeding rate is dependent on the level and coarseness of crop residue present, and higher rates of 5-8 lbs./ac are recommended under heavy and coarse crop residue. Adequate stand establishment is defined as 150,000 to 250,000 plants per acre (3.5-5.5 plants per square foot).

Growers should consult Table 1 below to find the seeding rate that accommodates their tillage method of choice and the tools available to them.

<table>
<thead>
<tr>
<th>Tool Used to Seed</th>
<th>Tillage Method</th>
<th>Seeding Rate (lbs./ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadcast Spreader</td>
<td>No-till</td>
<td>8</td>
</tr>
<tr>
<td>AirSeeder on Combine with Chopping Head</td>
<td>No-till</td>
<td>8</td>
</tr>
<tr>
<td>Grain Drill (seeded very shallow)</td>
<td>No-till</td>
<td>5</td>
</tr>
<tr>
<td>Broadcast Spreader</td>
<td>Tillage</td>
<td>5-8</td>
</tr>
<tr>
<td>Air Seeder on Tillage Equipment</td>
<td>Tillage</td>
<td>5</td>
</tr>
<tr>
<td>Grain Drill (seeded very shallow)</td>
<td>Tillage</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 1: Seeding Recommendation Table

Overall, the CoverCress crop responds to low plant density by compensating with larger plants under low-stand scenarios. However, it can react negatively (lower yield) under extremely high stands, so it is important to target the correct plant populations within the recommended range.
Many tools can be used to plant CoverCress seed including vertical tillage disks, light tandem disks, or diamond disk harrows fitted with air seeders to apply seed **behind the implement**. If a mounted seeder is not available, a broadcast spreader is another possible option.

*Photo 11: Air seeder mounted on a vertical tillage tool to plant CoverCress seed at the same time as doing light tillage.*

*Photo 12: Side view of tillage tool equipped with air seeder which places seed just in front of the rolling harrow (white tube at red arrow).*
3.3 Fertility Management

CoverCress™ plants naturally glean residual nitrogen and other nutrients from the soil surface throughout their life cycle. As in other cover crops, nutrient runoff is reduced, but the bonus of growing this crop is that the residual fertilizer is fixed into another **cash-producing crop**.

The best proxy right now for CoverCress nutrient removal at various yield levels is canola. Although estimates vary, the following tables generally outline removal of key nutrients for both pennycress and canola at 1,500- and 2,000-pound yield levels.

![Table 2: Tables showing nutrient removal in pennycress (left) vs nutrient removal in canola (right).](image)

Since most of the rapid growth in CoverCress plants occurs in the first half of spring, we recommend applying 40-50 lbs./ac of nitrogen in the early spring just before, or as, the plants begin to bolt after winter vernalization.

The form of nitrogen used can be granular urea or ammonium sulfate. In low-sulfur soils, ammonium sulfate may be a good option. The timing of this application should be when the soil conditions are conducive to field activities to avoid excessive damage and compaction.

It has also been found that the addition of boron may be needed especially in soils found to be boron deficient. Very little boron is removed in CoverCress grain; however, boron is a critical nutrient for proper development of the CoverCress plant and its leaf structure. Consult with your agronomist to determine the proper rates of boron for your area and soil types. Because of low nutrient removal rates for P, K, Mg, and Ca, we do not currently recommend supplementing these nutrients to support the crop in-season.
3.4 Harvest

Timing

Currently, in south-central Illinois, available CoverCress™ varieties are expected to reach maturity from May 20th-30th. Varieties are under development that will push harvest to May 20th or earlier.

The harvest window opens when 95% of the pods have turned at least to a bright tan color with the rest being some shade of yellow. CoverCress field maturity progresses very quickly under high temperatures (85 °F or higher) and good drying conditions.

As drying progresses, susceptibility to shattering also increases. It is likely that under good drying conditions, the harvest window will be about one week for initial varieties. With good stands, lodging generally will not be an issue as the branching habit forms a 30-36-inch-tall interlaced matrix of stems which is self-supporting under most weather conditions.

Photo 13: Mature CoverCress field ready for harvest.
Harvest Equipment and Transport

CoverCress grain can be harvested with a commercial combine and grain platform. Consult your combine operator’s manual for settings like those of canola, mustard, or rapeseed. A draper header has been found to provide the best uniform feeding and reduces risk of shattering.

It will be useful to use a straw chopper to size and distribute CoverCress straw across the field in preparation for the summer crop planting. Plants and pods should be fully mature; thus, pods should thresh easily when properly dry. Grain moisture can range from 10-20% at harvest but should be stored at 10-13%. (Note: Initially, contracted growers will not be required to store the grain. See Grain Delivery section below.)

Monitor yield losses carefully and adjust your combine to the crop conditions. Excessive reel speed can create pod shatter and increase yield loss. The combine should be “tight” as CoverCress seeds are very small, and leakage will reduce yields. Adequate stand establishment is probably the greatest key to yield performance, and good stands lead to more effective combine function. Stand is also the key to providing the greatest value as a cover crop over the winter.

CoverCress grain will need to be transported to the collection point in tight, covered trucks to avoid transport loss.

Photo 14: CoverCress plots being harvested by a research plot combine in late May.
3.5 Post-Harvest

Grain Delivery

It is imperative that harvest is planned so that delivery can be made to the grain handler within a 24-hour period to avoid grain spoilage. As part of the grower contract, the specific grain handling location will be identified for a grower’s region.

In the initial years as a contract grower of CoverCress™ grain, it will not be expected for growers to clean, dry, or store grain on their farm site. Until this crop is more widely grown, the cleaning and drying process will be handled by the delivery locations.

Terms of payment for the grain will be defined in the grower contract as well.

Planting the Following Summer Crop

The following summer crop may be no-tilled into freshly harvested and chopped CoverCress straw. Previous growers have observed soil tilth to be excellent following a CoverCress crop resulting in an exceptional, firm seedbed for summer crop stand establishment. With close cutting of the CoverCress crop ahead of corn or soybean planting, an initial chemical burndown of any developing summer annual weeds is not necessary as those weeds would have been destroyed by the CoverCress harvest.

Photo 15: Under a no-till system, a CoverCress research field is harvested by a research combine, and the farmer follows the combine planting his soybeans.
Chapter 4: Growth Cycle of the CoverCress™ Crop

As a winter annual, the growth cycle of the CoverCress crop is different than the growth cycles of summers crops already being grown. Because it requires a cold period called vernalization to flower, CoverCress seed must be planted in the fall to be harvested as mature plants in the spring. This chapter covers the growth stages of these plants chronologically.

4.1 Germination

Upon planting in the late summer or early fall, CoverCress seeds will germinate within a few days depending on adequate moisture, heat, and light availability. Germination requires availability of moisture at the soil surface for a period of 2-3 days. One or more rainfall events of 0.5 inches or more is ideal to settle the broadcast seed onto the soil surface and initiate germination. Light to moderate residue cover from the previous crop is useful in providing the soil surface moisture retention required to achieve good germination rates.

It has been determined that the most reliable germination will occur as daylength shortens toward a 12-hour daylength from late August into early October. Germination and stand establishment are generally detectable 1-2 weeks after planting when there has been adequate rainfall.

4.2 Seedling

Seedlings will appear as very small plants with two 1-2 mm cotyledons representing the first visual stage of seedling growth. These cotyledons will expand, and within a few warm days, the first true leaves will appear. Leaves continue to appear in pairs as development continues into the formation of a rosette.
4.3 Rosette

As the plants continue to develop in the fall, a relatively flat rosette is formed just above the soil surface. This rosette will vary in size from the size of a dime to as large as 4-inch diameter rosettes or even larger, depending on growing conditions (light, moisture, and temperature). Plants will continue to grow and develop late into the fall taking advantage of available light and heat. Generally, some growth can be expected when nighttime temperatures are at or above freezing, and daytime temperatures are at or above 45°F. As the physiological activity of the plants decreases due to lower temperatures, these rosettes will stay green throughout the winter appearing darker when frozen but greening up any time temperatures rise above freezing for a short period of days.

4.4 Bolting

In the late winter or early spring, a flowering structure, or bolt, will begin to form and elongate in the center of the rosette in response to warming temperatures and increasing light availability after the vernalization requirement has been met.

In the south-central Corn Belt this can occur as early as late-February to as late as late-March. The bolting process indicates that reproduction and flowering have been initiated. This also indicates that the crop is entering a very rapid growth phase that will extend through flowering. Plants will extend from a height of 1-3 inches tall to a fully formed canopy of up to 30 inches or more during the following 4-6 weeks through the completion of flowering.
Bolting is followed by budding and flowering of the plants, stages which are sensitive to temperatures below freezing.

4.5 Budding and Flowering

Shortly after the beginning of budding, flower formation will start at the tips of the bolts. Small white flowers will form in clusters at the ends and along the side shoots of the bolts. There will likely be multiple flowering stems per plant as flowering proceeds with each stem likely bearing multiple sub-stems. Elongation of these stems occurs quite quickly.

Flowering itself will last from 2-4 weeks from beginning to end depending on the variety and the weather (cooler = longer, warmer = shorter). Sub-freezing temperatures can cause flower or pod abortion on sectors of the flowering stems that are in the process of pollination or seed set when the sub-freezing temperatures occur. The same phenomenon can happen under very high temperature stress during flowering (daytime highs greater than 92 °F).

Except in extreme cases, flowering will continue after the damaging temperature episodes, and flowerless sections will occur on the flowering stems in proportion to the length of the damaging temperature event. Within a few days after flowers appear, small, round- to heart-shaped pods will appear along the flower stems indicating seed set.
Photo 24: Multiple flowering sub-stems on a single CoverCress plant in early spring.

Photo 25: CoverCress field in full bloom in spring.
4.6 Pod Set

Throughout the two- to four-week flowering process, pods are continually being set along the flowering stems. Flowering stems will likely contain pods ranging in size from 1+ cm in diameter down to 2 mm in diameter. The pods will each normally contain 10-14 green seeds. As flowering ends, the pods mature and equilibrate to approximately the same full size with the latest developed pods being slightly smaller than the first pods to develop.

![Photo 26: Stem of CoverCress plant midway through pod set.](image)

![Photo 27: CoverCress field at completion of pod set.](image)

4.7 Maturity

As seed in the pods begins to mature, pods begin to turn from dark green to light green to yellow. The process of maturity occurs over a three- to four-week period after completion of flowering, depending primarily on temperature. Seed maturation approaches as pods turn yellow. Yellow pods turn to a bright tan color as maturity progresses toward completion. Pod color will progress from bright tan to a duller tan or gray color as dry-down occurs. Harvest should be delayed until a large majority of pods (95%) reach the bright tan stage.

Moisture content of the grain should range from 16-20% at this stage. Harvest should not be delayed beyond the time a large majority of the pods are dull tan or gray (11-14% moisture) as the probability of yield loss due to pod shatter increases as this stage progresses.
Photos 28-32: Progression of CoverCress crop color through phases of maturity starting in the upper left and moving downward.
Chapter 5: In-Season Agronomic Issues

Just like any other crop, CoverCress™ fields can experience in-season agronomic issues such as diseases, insects, and weed competition. This chapter addresses the known issues that have been recognized in the field. Descriptions of the damage along with the stage of growth, time of year, or weather conditions at which such damage can be expected are listed by topic below. If concerns about the crop arises, growers can always contact CoverCress Inc. to help with diagnosis and decisions for treatment.

5.1 Disease Issues

Several diseases of brassica crops such as canola also can affect CoverCress plants. As is usually the case, weather during the growing season significantly affects the appearance and level of severity of these diseases. Some of the most frequently observed diseases are listed below.

Alternaria Black Spot

Alternaria black spot is a fungal disease caused by any of the three pathogens *Alternaria brassicae*, *A. alternata*, or *A. raphani* that affects leaf and pod tissue and can cause some yield loss and loss of seed viability. Alternaria can infect the crop at any growth stage, but it generally appears as temperatures warm, humidity rises, and rainfall becomes more frequent in mid-spring. Early infection before bolting and flowering is not considered to be problematic; however, under certain conditions Alternaria infection can increase as pods start to mature and plant tissues start to age causing affects in yield and seed viability. At this time, CoverCress Inc. does not recommend treating with a fungicide. Contact CoverCress Inc. for fungicide spraying decisions and recommendations.

Staghead Disease or White Rust

The fungus *Albugo candida* causes the disease known as Staghead disease or White rust. The most conspicuous symptom is the presence of swollen, twisted, and distorted inflorescences called "stagheads" that become brown, hard, and dry as they mature. Stagheads develop from infected flower buds. The formation of stagheads reduces the amount of seed produced because the flowering structures have become malformed. Management practice would be to control cruciferous weeds which transmit this fungus as well as using a crop rotation that allows three years between brassica crops. The spores of the fungus can be spread at harvest when the stagheads are threshed. Contact CoverCress Inc. for fungicide spraying decisions and recommendations.
Sclerotinia White Mold

Sclerotinia white mold or *Sclerotinia sclerotiorum* is a fungal disease which causes stem rot. In severe cases, it can lead to premature plant death, lodging, and shattering loss. This disease is most prevalent during extended cool and wet conditions at the flowering and pod fill stages. In most cases, if prevalence is not severe, and stands are at the prescribed level, lodging associated with Sclerotinia white mold will be minimal. However, the greater issue with Sclerotinia is potential shattering of infected plants on which pods die and mature earlier than healthy plants and thus increase susceptibility to shatter as harvest time approaches for the healthy plants.

Sclerotinia can be controlled with various fungicide spray programs. However, spraying should not be routine as it is not cost effective to spray low-level infections. Spraying would be recommended at the peak of flowering if it is necessary.

CoverCress Inc. is developing a scouting process based on canola to support spray recommendations. Contact CoverCress Inc. for fungicide spraying decisions and recommendations.

Seedling Disease Complex

*Rhizoctonia solani*, *Fusarium* spp. and *Pythium* spp. are fungal diseases causing a rotting of either the root tissue, the crown tissue or lower stem tissue which leads to seedling stand loss. Random low-level stand loss is not a concern since this crop is remarkably effective at compensating for stand loss through the development of larger surviving plants. In severe cases, complete fields or field areas can be lost. These diseases thrive when seedlings are under stress or when wet conditions exist over long periods at the soil surface. To minimize the risk from seedling diseases, follow previously discussed field selection and seedbed preparation recommendations.

Currently, there is no confirmed resistance to these diseases in the CoverCress varieties. Seed treatments for control are
under evaluation. Contact CoverCress Inc. if there are concerns about the adequacy of your stands in the spring at the pre-bolt stage of the crop.

5.2 Insect Issues

There are a few insects which have been observed on developing CoverCress™ plants in the field.

**Aphids**

Colonies of aphids (Family Aphididae) are sometimes observed in the early spring and during rapid growth and flowering. These colonies appear during warm periods and can expand very quickly. Young leaves will show curling, and older leaves may be discolored or “dirty” looking. The aphids will reside on the undersides of leaves and stems. The damage they cause is localized to the stems, flowers, and leaves they feed on. This often diminishes the ability to flower and set seed on affected plants. Fortunately, observations to date have been that significant rainfall or cold temperatures provide effective control of this pest. If severe infestations occur, spraying with a labeled insecticide is an option.
Flea beetles

Flea beetles (Family Chrysomelidae) have also been observed on seedlings, on the developing crop, and in harvested grain. Flea beetles can cause feeding injury which can be significant with characteristic damage of feeding divots, shot holes, and necrosis around the holes. Warm, dry weather promotes flea beetle activity, but to date we have not observed severe injury from flea beetles. In severe infestations, spraying with a labeled insecticide is an option.

Thrips

Thrips, some of which are nearly microscopic and bite, have occasionally been observed in the field as well. Thrips are attracted to pollen and generally feed on developing flowers causing sterility. Our observation of thrips has been past the peak of flowering when thrips would be expected to be most damaging. Generally, we believe that in the field, thrips require adequate heat for their life cycle completion; thus, they largely miss the susceptible flowering stage of CoverCress plant development. Thrips are much more of an issue for these plants in the protected and warmer greenhouse environment where we do much of our year-round research work.

Photo 39: Thrips feed off of and damage the flower buds of CoverCress plants so that the plant will not set seed from the main flowering shoot. Weak side stems may develop, but seed production will be diminished.

5.3 Weed Control/Weediness

Currently there is no defined chemical broadleaf weed control system for this crop. CoverCress™ plants are at least moderately susceptible to all available broadleaf herbicides. However, if adequate stand establishment (as defined in this document) is achieved and existing weed seedlings are controlled through light tillage or (non HPPD-inhibiting) chemical application just prior to CoverCress planting, the crop will compete well with its primary winter annual broadleaf weed competitors (henbit, shepherd’s purse, chickweed, and purple dead nettle). Grassy weeds are not as much of an issue, but if control is needed, any labeled selective grass killer will achieve control. CoverCress Inc. is in the process of developing ALS-resistant CoverCress varieties so that herbicides such as Classic™ might be used as a chemical weed control system. This system will not be available for initial variety releases.
The other weed-related question that arises with the CoverCress crop is whether it will become a weed problem in the rotation with corn and soybeans. As a winter annual plant, CoverCress growth is highly inhibited or killed by mid-summer heat that would be present during the growing period of corn and soybeans. In addition, even if these plants were to survive the summer heat, they are relatively small and non-competitive and are not likely to survive in a corn and soy canopy due to lack of light. Finally, as a winter annual, CoverCress plants require a long period of cold temperatures below 40 °F to flower and set seed and thus will not set seed within a summer corn or soybean growing season.

5.4 Crop Insurance

If you do not have a history of double cropping, you will need to consult with your crop insurance advisor regarding how to properly insure your CoverCress™ crop and your follow-up corn or soybean crop. Currently, the CoverCress crop (field pennycress) is not labeled as an insurable crop.
Chapter 6: Future Developments of CoverCress™ Varieties

Over the next few years, we hope to continue to move the harvest date of the CoverCress crop earlier toward May 15th through genetic selection. We will also work to advance the genetics to increase yield to over 2,000 lbs./ac to improve the economics across the value chain.

To help expand the growing of this crop, we are looking at alternative seeding methods that are economical and effective. Methods such as drone seeding in a standing crop just prior to harvest and seeding with a combine at the time of harvest are a couple of these methods. As interest grows in seeding soybeans earlier, we are looking into options that would allow interseeding of soybeans into pre-bolting CoverCress fields. This could allow a grower to achieve two goals: the early seeding of soybeans for optimum yield and the cash benefit of growing CoverCress grain.

Research and development is underway to develop a CoverCress variety that is herbicide-tolerant. This will allow growers to apply a broadcast herbicide that will control both winter and spring annuals that will compete with the crop. Additional research is also being conducted to look at improved disease resistance in CoverCress varieties.

The CoverCress grain is in the initial evaluations for food-grade oil and protein use. These advancements will allow for further usage of this valuable grain.

We are in the early stages of research to understand how CoverCress plants capture carbon while helping provide a sustainable crop for farmers.
Frequently Asked Questions

Q: How much will CoverCress™ seed cost?
A: CoverCress™ seed will be provided at no cost to contracted farmers in the fall of 2022.

Q: What/where are the markets for CoverCress™ grain?
A: CoverCress will contract with farmers to raise the CoverCress grain crop. This contract will outline location and price to be received upon delivery. CoverCress has worked diligently to develop a market for whole grain chicken feed to scale a future transition to crush with products sold as feedstock for biofuel and animal feed markets.

Q: Where will our grain collection points be located?
A: CoverCress is developing partnerships with grain handlers to be at the ready for the first contracted growers in the fall of 2022. The grower’s contract will outline the delivery location as well as trucking reimbursements.

Q: What are the agronomic and management considerations for growing a CoverCress crop?
A: Please see our growers guide for in-depth information on all aspects of growing CoverCress grain.

Q: What is the optimum planting window for the CoverCress crop?
A: For the launch area of central Illinois, the optimum planting window is from Labor Day to October 10th. Adequate rainfall, seasonal temperatures, and day length are critical to stand establishment. Stand establishment in the fall is critical for a timely harvest in the spring.

Q: How should I be thinking about the impact to my early-planted beans if I grow a CoverCress crop?
A: Consider growing this crop on a portion of your acres that would require planting beans a bit later as a hedge for some of your early-planted soybean acres.

Q: Can I plant corn after I harvest my CoverCress crop instead of soybeans?
A: Yes, if growing corn after your CoverCress crop fits well with the rotation and you are willing to plant corn later, this rotation is acceptable.

Q: What would be the advantages and disadvantages of replacing winter wheat with a CoverCress crop?
A: CoverCress harvest would be 2-3 weeks earlier than winter wheat. This would provide an advantage if double crop soybeans would be planted after your CoverCress harvest. Additionally, the nutrient requirements would be much less than that for winter wheat. A disadvantage would be the lack of straw value from CoverCress plants versus winter wheat.
Q: Is there any value to the residue after harvest?
A: No, there is very minimal residue remaining after CoverCress harvest. The residue following CoverCress harvest should be chopped and distributed evenly over the field for a good stand of the following crop to establish.

Q: How does growing CoverCress compare to winter canola?
A: CoverCress grain has similar characteristics to winter canola for oil quality and feed stock quality. An advantage to growing this crop is that it may provide an alternative crop option that requires minimal inputs for planting, fertilization, and early harvest for a second crop where winter canola has not been adopted.

Q: Are CoverCress plants considered legumes?
A: No, CoverCress plants are brassicas, so they are related to mustards.

Q: How big is a CoverCress seed?
A: A single CoverCress seed is extremely small and measures roughly 1 mm in diameter compared to soybean seed, which ranges from 5 to 11 mm.

Q: What is the seeding density of a CoverCress field?
A: It is recommended to plant CoverCress seed at 5-8 lbs./acre in lightly tilled soil.

Q: What happens if it looks like I do not have a good stand?
A: Our research to date indicates that an adequate stand of CoverCress requires a minimum of four plants per square foot to justify a spring nitrogen application when the plants are in the pre-bolting stage.

Q: How and when is a decision made NOT to take a CoverCress field to harvest?
A: We are currently researching imagery technologies that will assist with these decisions. But currently, if there is not sufficient stand establishment as of the pre-bolting stage in the spring, the crop would be terminated rather than harvested.

Q: Would the application of a desiccant help speed up crop maturation and harvest?
A: We are currently conducting research trials to determine if the application of a desiccant will significantly alter the quantity of oil and meal from the harvested grain. As we continue to study the crop, we may be able to establish a desiccation process as a best management practice to provide a timelier harvest window in the spring.

Q: Is the only nitrogen application that is needed the one in the spring?
A: Yes, CoverCress plants can utilize residual nitrogen in the soil carried over from the preceding crop. In the spring, CoverCress recommends an application of 40-50 lbs. of nitrogen per acre at or just prior to bolting, ideally when the soil conditions are appropriate for ground applications.
Q: What forms of nitrogen can I apply to my CoverCress crop?
A: The timing and rate of nitrogen application may be more critical versus the form. We recommend granular urea or ammonium sulfate in the spring versus liquid forms of nitrogen, such as UAN solutions, which may cause injury to the leaves or budding flowers.

Q: How do herbicides like 2,4-D, dicamba, and glyphosate impact CoverCress plants?
A: 2,4-D, dicamba, and glyphosate will kill CoverCress plants. Special care should be taken when applying these herbicides near a growing CoverCress field.

Q: Are there herbicides that could carryover that could impact my CoverCress crop?
A: Data also shows CoverCress plants are especially susceptible to HPPD-inhibiting herbicide carryover, and fields should be selected with this in mind. The mode of action in HPPD-inhibiting herbicides (Isoxazole, Pyrazolone, Triketone) has been shown to impact CoverCress plant development and would likely impact yield if damage is significant enough.

Q: Should I be worried about CoverCress volunteers affecting the following crop?
A: CoverCress volunteerism is significantly different than that of field pennycress due to the advances made via gene editing. In the event of off-season volunteers, the plants will not survive summer conditions and will be controlled with many herbicide management practices.

Q: Pennycress is listed as a restricted noxious weed in some states. Which states in your ultimate market have this issue, and how are you working to address it?
A: CoverCress is currently addressing the issue in states where pennycress is listed as a noxious weed. We are working diligently with the Department of Agriculture in multiple states to ensure the expansion of CoverCress in the future.

Q: What benefits does a CoverCress crop provide to the soil?
A: CoverCress will provide similar benefits as other cover crops, including improved soil tilth, nutrient capture, partial over-winter soil cover, and soil protection from spring erosion.

Q: How much carbon does one acre of CoverCress plants sequester on a numerical scale? What are the economic benefits of carbon sequestration for my operation?
A: Early estimates indicate about 1 ton per acre of carbon is sequestered from growing CoverCress. We are still learning about the carbon markets as this is a rapidly developing and changing topic.

Q: What agronomic support will CoverCress provide me as a grower?
A: CoverCress is developing a network of agronomists who will help provide local support for growers.

Q: I am currently out of your target area. When can I expect the chance to participate?
A: CoverCress’ product development to this point is targeted to central Illinois and eastern Missouri. We are continuing to test and develop products that will allow us to expand beyond our target launch area to ensure each grower has success with our crop.
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