# Self maintaining cover crops using winter annual oilseeds

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## INTRODUCTION

Cover crops could provide significant ecosystem services in corn and soybean rotations through increasing vegetation year round.

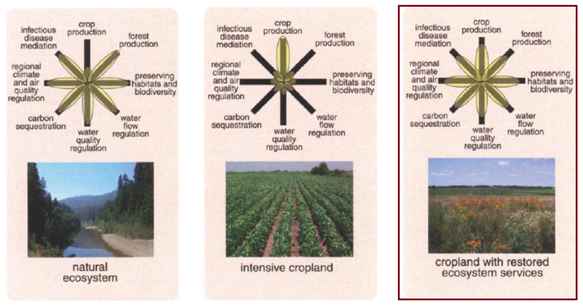


Figure 1. Balance of ecosystem services with highly productive agricultural systems (Foley et al., 2005)

*Problem*: The use of cover crops in corn and soybean rotation is limited because of production and economic risk to farmers.

*Challenge*: Identify cover crops options that reduce production and economic risk to farmers.

Two winter annual species, pennycress and camelina, have potential for use in relay cropping systems as cash cover crops (Figures 2 & 3).

These species are prone to shatter and may supply enough seed to re-establish the cover crop by the end of the season. This may eliminate the need to reseed the cover crop each year while maintaining a continuous living cover.

| | Pennycress (*Thlaspi arvense*) | Camelina (*Camelina sativa*) |
|---|---|---|
| Planting date | September/ October | August - October |
| Harvest date | Late June/ - July | Mid June |
| Yield | 1200 lb/ac | 1800 lb/ac |
| Uses | Food grade, biofuel | Biofuel |
| Seed characteristics | Dormancy, seed shatter | Seed shatter |

Figure 2. Characteristics of pennycress and camelina seed production in a relay cropping system

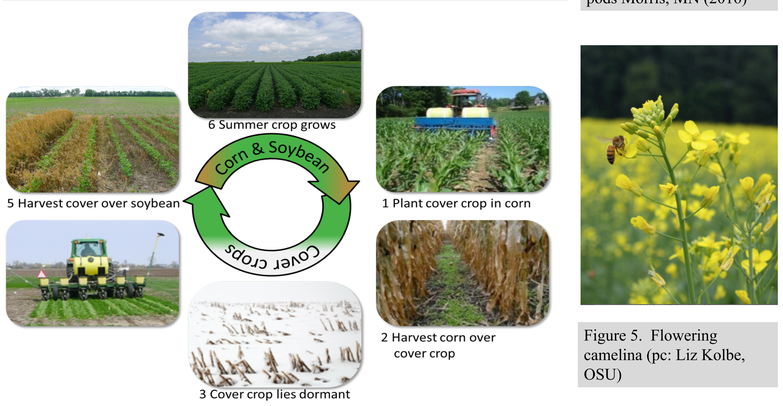


Figure 3. Relay system for incorporation of cash cover crops in corn-soybean rotations

Figure 4. Pennycress seed pods Morris, MN (2016)



Figure 5. Flowering camelina (pc: Liz Kolbe, OSU)

## OBJECTIVES

1. Quantify seed shatter of pennycress and camelina in soybean relay cropping system
2. Evaluate emergence and development of pennycress and camelina seedlings throughout the growing season

## MATERIALS & METHODS

### *Experimental Design*

Randomized Complete Block Design
- Five treatments (one check)
- Three replications

Establishment
- Seeded late August 2015 into R6 corn
- High clearance seeder (Fig. 6)

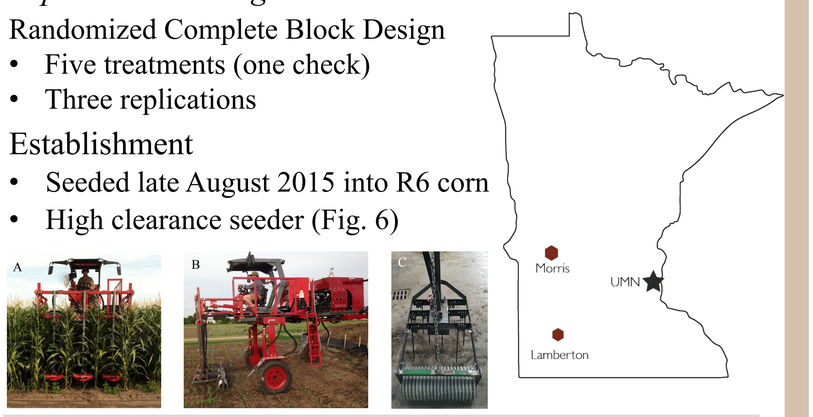


Figure 6. High-clearance seeder (A and B) equipped with soil incorporation (C) units for enhanced seed-soil contact. Oilseeds directed broadcasted via mounted Gandy™ Orbital Air Seed.

Figure 7. Pennycress and soybean growing simultaneously in Lamberton, MN (2016)

Management
- Relay planted soybean into standing cover crop May 10, 2015 (Figure 7)
- Harvested cover crops at two maturities (Figure 8)

### Experimental Treatments

| Winter Annual Cash Cover Species | Abbreviation | Harvest Treatments |
|---|---|---|
| Camelina (*Camelina sativa*) | HD1 | At physiological maturity |
| | HD2 | One week post maturity |
| Pennycress (*Thlaspi arvense*) | HD1 | At physiological maturity |
| | HD2 | One week post maturity |
| No Oilseed | | Conventional soybean check |

Figure 8. Explanation of treatments

### Parameters Measured

1) Seed loss in count per 12.7 $cm^2$ container (Figure 9 & 10)
   - Set one week before harvest (Pre-harvest loss)
   - Set at combine harvest (Combine loss)

Figure 9. Seed shatter container placed in camelina prior to combine harvest (Morris, MN)

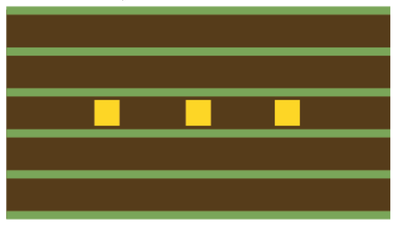

Figure 10. Seed shatter container placement prior to oilseed harvest in center of plot.

2) Percent cover of emerging oilseeds (0.25$m^2$ quadrat)
   - 6 weeks after harvest
   - Triplicate images
   - Images processed in Matlab and ImageJ (Figure 11)

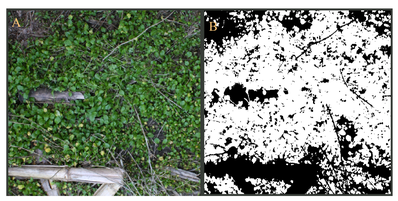


Figure 11. A)Pennycress emergence, 6 weeks after oilseed harvest (Lamberton, MN). B) Processed in Matlab.

3) Measure soybean yield across each treatment

## RESULTS

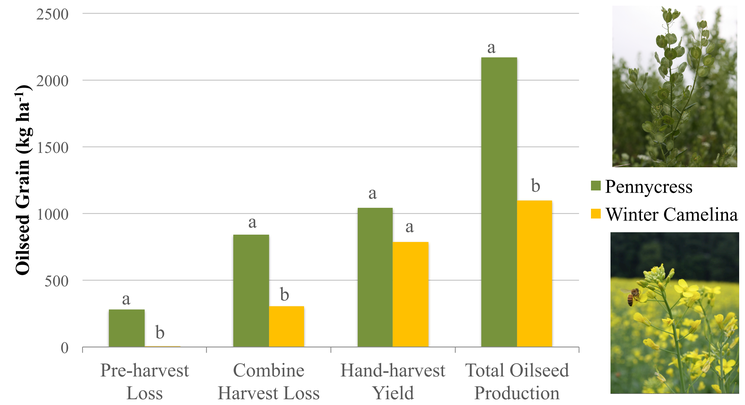


Figure 12. Oilseed grain yield and harvest loss for pennycress and winter camelina before and after combining averaged over environments (Morris 2016, and Lamberton 2016) and oilseed harvest treatment. Oilseed grain yield means for each harvest treatment effect followed by the same letter are not significantly different based on Fishers Protected LSD test at $P < 0.05$.

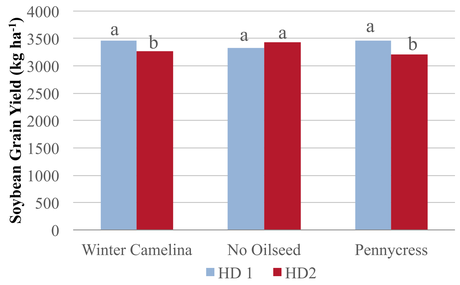


Figure 13. Soybean grain yields as influenced by oilseed grain yield harvest dates and relay oilseed treatment for Morris, MN (2016). Oilseed species did not impact soybean yield ($P = 0.59$) whereas harvest date did ($P < 0.03$). Soybean yield was impacted by the oilseed species by harvest date interaction ($P < 0.02$). Soybean yield means across harvest date and oilseed treatment follow by the same letter are not significantly different based on Fisher Protected LSD at ($P < 0.05$).

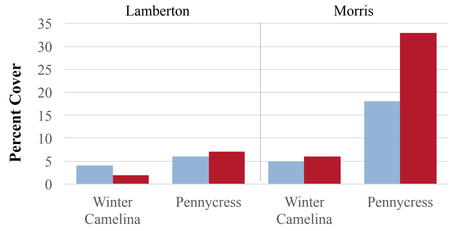


Figure 14. Percent seedling cover, six weeks after oil seed harvest. Mean percent cover was averaged over three sub-samples. Percent seedling cover was different ($P < 0.05$) across both locations. Oilseed within location was different ($P < 0.05$). Harvest date was significant at Morris ($P<0.05$) only.

## CONCLUSION

- Winter camelina and pennycress seed shatter provided up to 33% soil cover by August 10
- Camelina and pennycress seed shatter is higher than what is necessary to reseed the cover crops
- Soybean yield was not significantly affected by cover crop species or harvest date

Figure 15. Emerging pennycress (Morris, MN)

### Future Research
- Evaluate percent cover of pennycress and camelina going into winter vernalization
- Assess stands prior to planting of cash cover crop in the spring of the second year
- Conduct research in both agronomics and plant breeding to reduce seed shatter and harvest losses

## ACKNOWLEDGEMENTS

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