Planting Green - Extending the Growing Season to Get More Payback from Cover Crops

FINAL REPORT to the Maryland Soybean Board for April 2020 – March 2021

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This final report covers the period between April 1, 2020 to March 30, 2021. Covid-19 restrictions promulgated by the state of Maryland and by the University of Maryland continued to make it difficult to accomplish research objectives especially with regard to working with undergraduate students who normally constitute our main labor force. However, restrictions were relaxed somewhat in the fall semester and we were able to make good progress on several fronts.

Figure 1 Three-species cover crop established in corn (L) and soybeans (R) on sandy soil at Beltsville, MD using a Penn State-type Interseeder drill. Commercially available models of the interseeder can side-dress liquid N and spray herbicides while drilling three rows of cover crop between 30-inch cash crop rows. Cover crop photos from 2020 research season. Implement photo: Interseedertech.com.

To establish the early planted cover crops for this experiment we first established both corn and soybean crops in 30-in wide rows in Early May on three sites at the University of Maryland research station near Beltsville. In late June we used a Penn State University-style inter-seeder drill to establish two types of cover crops in the young cash crop stands. The two cover crops established were a three-way mix of radish, crimson clover, and rye and a single species cover crop consisting of just cereal rye. The Penn State interseeder worked very well on the site with sandy soil because moisture conditions were good at the time of interseeding in June and excellent cover crop stands were established at two sandy sites with both soybean and corn plots (Figure 1).

At the finer-textured site, conditions were quite wet during June so that the no-till interseeder drill failed to achieve good seed furrow closure, and stands emergence was very spotty. We did stand counts of the cover crops to document this difference in seeding effectiveness (Figure 2).

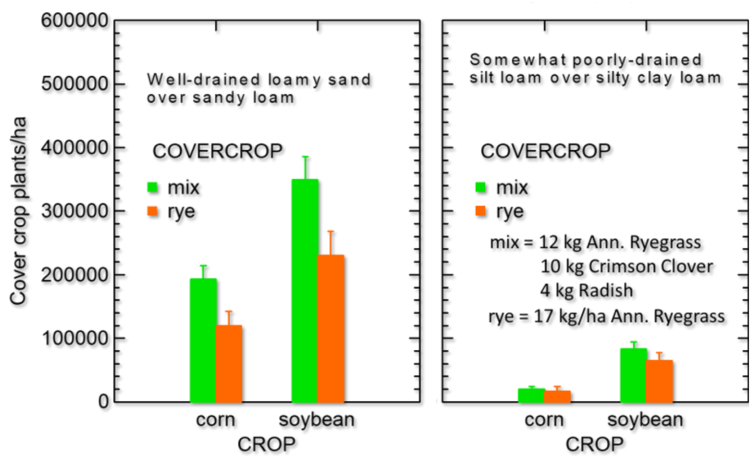

Figure 2 Cover crop stand counts on in two experiments at Beltsville, MD 1 month after drill-interseeding either pure rye or a radish-clover-rye mixed cover crop seed at cash crop lay-by time in June. Soil moisture on the sandy soil (left) was ideal for seeding, but the soil moisture in the silty loam soil was too high for proper seed furrow closure, hence the very poor stand establishment in the finer textured soil.

In the sandy soil fields where the seeding was most successful, we observed that survival of the interseeded cover crops was much better where the cash crop rows ran East to West than where they ran North to South (Figure 3). We speculate that this was a function of sunlight penetration. In the middle of summer, light penetration was continuous from early morning to late afternoon in the East-West oriented row crops. However, light penetration was effective only at midday in the corn and soybean plots with North-South oriented rows. In these plots, the cash crop row to the east of the interceded cover crop strip shaded the interrow from the morning light. The cash crop row to the west of a cover crop strip shaded the interrow from the afternoon and evening light. As a result of this differential shading effect, the interseeded cover crops survived through cash crop maturity in the East-West rows but died, probably from lack of sufficient light, in the North-South rows.

Figure 3 . Post corn harvest results of drill interseeding a 3-species mix cover crop into corn at lay-by in Field 39D (left) with rows oriented East to West and in Field 39A (right) with rows oriented North to South. The same corn hybrid, fertility, planting date and cover crop planting date were used in both fields which are adjacent and share a Downer sandy loam soil. Photos taken in October 2020 immediately after corn harvest.

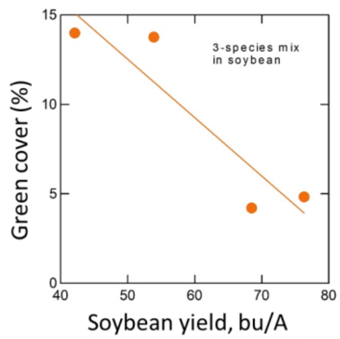

Figure 4 Post harvest green ground cover achieved by 3-species cover crop as relat4ed to yield of soybean crop into which the cover crop was interseeded in June.

For interseeding into soybean with North south-oriented rows, the survival of the cover crop through the summer and early fall was poor. Our speculation that this was related to competition for light is supported by the negative relationship between the cover crop percent ground cover achieved and the yield of the soybeans (Figure 4). The best cover crop stand was achieved where the soybeans grew the worst. We believe this was an effect of the soybeans on the cover crop and not the effect of the cover crop on the soybeans.

Overall, the cover crops interseeded in June did not affect the yield of either corn or soybeans in October in either the fine-textured or the coarse-textured field experiment (Figure 5).

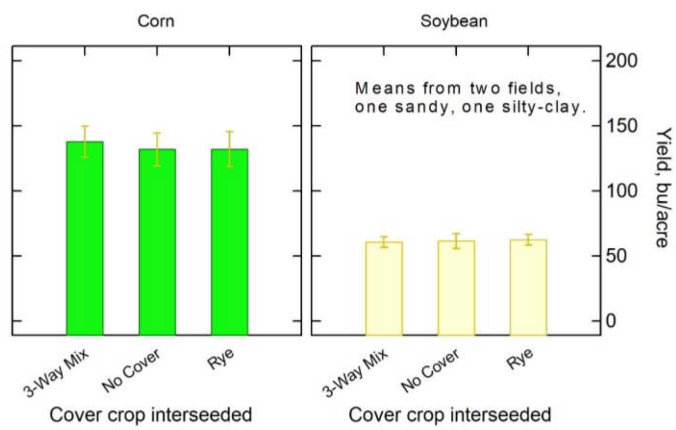

Figure 5 Yields of corn (left) and soybean (right) was not influenced by interseeded cover crops. Means for two sites, one with sandy and one with silty soil.

We continued to monitor the cover crop growth and condition during the winter and have observed that the radish component was severely frost-damaged with temperatures around 20 °F for several nights in December. Complete winterkill of radish was not achieved despite nighttime temperatures as low as 17 °F in early February. Therefore, scattered radish plants began to flower in late March. The large roots from early-planted radishes did die and were partially decomposed by the end of March.

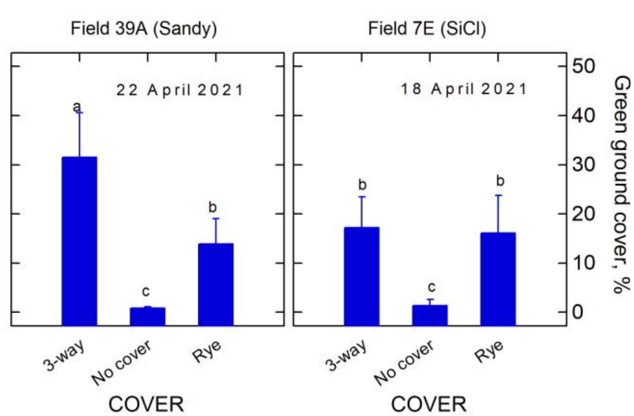

Figure 6 Green cover (%) determined by the CANOPEO app.

Cover crop biomass and green groundcover percentage was measured on 02 April and 18-22 April 2021, just before the early- and mid-kill dates. The percent green groundcover in each field for each cover crop treatment just before the mid-kill date is shown in Figure 6. The three-species mix had produced significantly more green cover (and biomass) on the sandy soil than the other treatments. Also, as expected, the no cover control had less green cover than either cover crop on both soil.

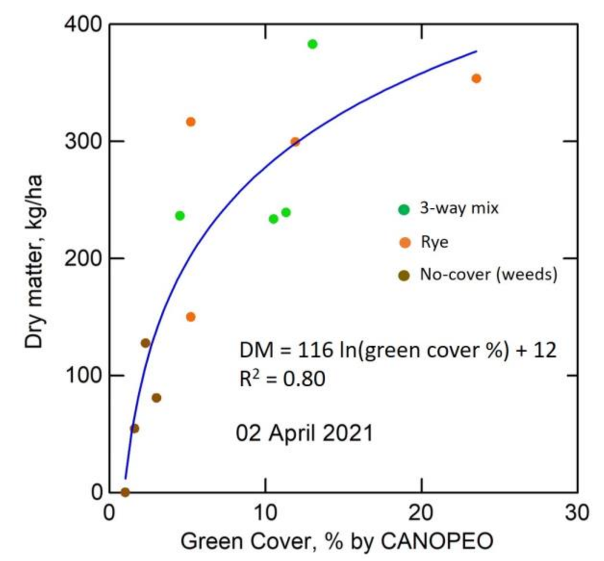

Figure 7 The percent green cover measured by the CANOPEO app was reasonably good predictor of cover crop dry matter.

These measurements of green groundcover were made using an open-source smart phone app called CANOPEO. The app analyzes photographs or video taken vertically from about 5 ft above the ground and separated the image into shade of green living vegetation and black for all other materials (soil, dead residue, etc.). This non-destructive, rapid technique is useful for estimating the growth of cover crops, especially young, small plants. For the large inter-seeded plots of cover crops we walked diagonally across a plot from one corner to the opposite corner while the app analyzed 30 video images. The percent cover from this image analysis was closely related to the biomass dry matter determined by clipping $0.25m^2$ vegetation close to the ground, then washing, oven-drying (at 65^oC) and weighing the material (Figure 7).

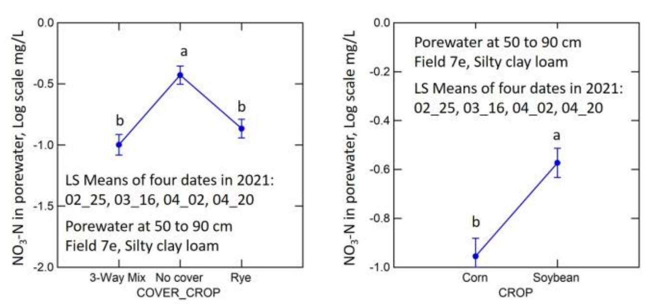

Figure 8 Nitrate leaching as affected by cover crop and previous crop. Note the log scale for nitrate – N in subsoil porewater. For example, Log -1.0 = 0.1 mg/L, log 0-0.5 = 0.33 mg/L).

A total of 48 tension lysimeters were installed in the silty clay loam field to sample the drainage water as it percolated past 50 or 90 cm (2ft or 3 ft) depths as an indication of the nutrient loss by leaching. Combining samples from four sampling dates between 25 February and 20 April and averaged across both depths we observed nitrate-N concentrations about three times as high under the control plots as under either cover crop when averaged across soybean and corn crop residues (Figure 8, left). When averaged across all cover crop treatments, nitrate-N was about three times as concentrated under soybean residue and under corn residue (Figure 8, right). However, all values for nitrate-N were quite low, being less than 1 mg/L (1 ppm).

This Spring (2021) the cover crops will be terminated, and soybean planted into the plots that had corn in 2020 and corn planted in the plots that had soybean in 2020. Corn and soybeans will be planted in early May (05 May target date) into green living cover crops and compared to plots where cover crops were terminated ~4 weeks and ~2 weeks ahead of corn and soybean planting. Slugs will be counted periodically for a week before and two weeks after soybean planting using shingles pinned to the ground in 40 plots of Field 7e (silty clay loam) where slugs have been observed during the winter. After emergence, slug damage to soybean will also be scored and recorded. Surface temperature and soil moisture will also be recorded with slug counts. The effect of cover crop kill date (4 or 2 weeks prior to planting or 1 week after planting) will be determined for rye, three-way mix and no-cover (weedy) treatments. The corn plots will again be drill-interseeded with cover crops in June, but the soybean will be air-seeded at leaf drop in early September because of the near-total lack of survival under the soybean canopy for cover crops drill interseeded in 2020. Plant nitrogen, early growth, soil water and temperature, weeds, slugs, pests, and yields will be evaluated.