Irrigated Soybeans Planted Following a Cover Crop Mix and No Cover Crop

Study ID: 0914093201901
County: Howard
Soil Type: Holdrege silty clay loam
Planting Date: 5/16/19
Harvest Date: 9/30/19
Seeding Rate: 180,000
Row Spacing (in): 30
Variety: AgriGold® G2405RX
Reps: 5
Previous Crop: Corn
Tillage: No-Till
Herbicides: ***Pre:*** 25 oz/ac BroadAxe®XC and 48 oz/ac Gramoxone® SL ***Post:*** 12.8 oz/ac Engenia® and 32 oz/ac Buccaneer® 5 Extra
Seed Treatment: fungicide, insecticide, inoculant
Foliar Insecticides: 2 oz/ac Warrior II with Zeon Technology®
Fertilizer: 108 lb/ac 11-52-0, 87 lb/ac 0-0-22-22 S-11 Mg, and 23 lb/ac 98% lime
Irrigation: Pivot
Rainfall (in):

Introduction: This study is being conducted on a soil health demonstration farm as part of the Nebraska USDA/Natural Resources Conservation Service's (NRCS) Soil Health Initiative, and involves the farmer, the Nebraska On-Farm Research Network, and the USDA/NRCS. The study compared the effects of a cover crop mix on soybean yield and soil health properties. The cover crop mix was Barkant turnips, African cabbage, Impact Forage Collards, Dwarf Essex rapeseed, Eco-Till radish, Peredovick sunflowers, safflowers, VNS hairy vetch, Viceroy lentils, and cereal rye. The cover crop was seeded after corn harvest on September 21, 2018. Cover crops that did not winter terminate were terminated with herbicides on May 14, 2019 at a height of 3". Soybeans were planted on May 16 in 30" row spacing. Soybeans experienced damage from heavy thistle caterpillar infestations. This is the second year of the study and second planting of cover crops on the same cover crop treatment strips; however, it is the first year reporting crop yields and soil health measurements. Due to visual differences observed in imagery and crop senescence, additional grain quality samples were collected.

Results:

Table 1. Soil physical, chemical, and biological properties for cover crop and no cover crop treatments. Samples were collected on 10/29/19 (1 sample per treatment replication, 7 samples per treatment).

Treatment	Infiltration (in/hr)	Soil moisture (%)	Bulk density (g/cm^3)	Soil temp. (F)	Soil respiration[1]
Check	0.59 A*	21.51 A	1.16 A	47.71 A	3.64 A
Cover Crop Mix	0.62 A	23.33 A	1.15 A	46.69 A	4.43 A
P-Value	0.781	0.616	0.817	0.521	0.297

[1]Soil respiration (Modified Solvita burst).
*Values with the same letter are not significantly different at a 90% confidence level.

Table 2. NRCS field assessments of soil health. Samples were collected on 10/29/19 (1 sample per treatment replication, 7 samples per treatment).

	NRCS Field Assessment of Soil Health								
Treatment	Structure	Structure type	Surface condition	Mgmt	Soil pores	Earth worm	Biological activity	Soil smell	Overall indicator[2]
Check	1.79 A	1.86 A	2.21 A	1.43 B	2.00 B	1.57 A	1.71 A	1.57 A	1.77 B
Cover Crop Mix	2.00 A	2.00 A	2.00 A	2.50 A	2.21 A	1.64 A	2.00 A	1.64 A	2.00 A
P-Value	0.199	0.172	0.199	<.0001	0.078	0.766	0.103	0.604	0.001

[2]Score based on field assessment. The overall indicator score is based on the sum of 8 indicators (averaged from 1-3; 1=degraded, 2=in transition, 3=healthy): soil structure, structure type, surface condition, soil management, soil pores, earthworms, biological activity, and smell.

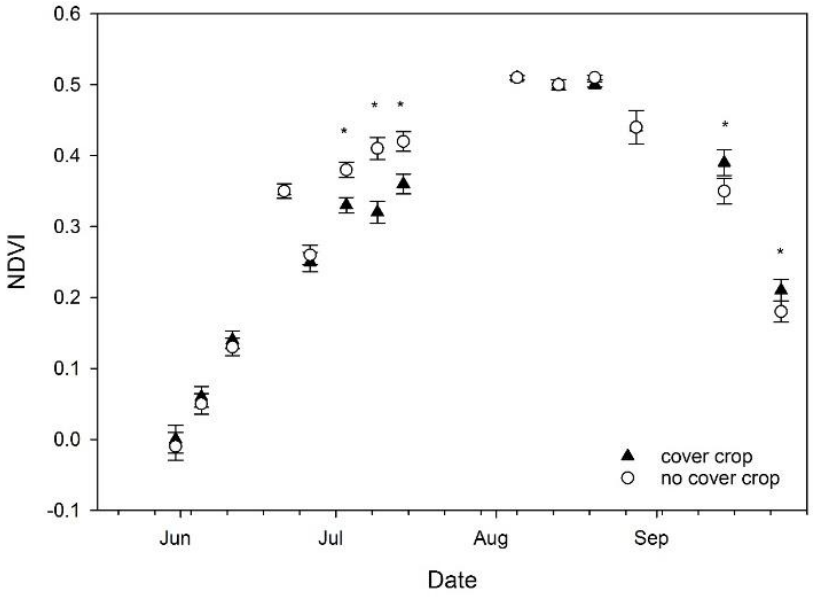

Figure 1: Average normalized difference vegetation index (NDVI) values for soybean planted on previous cover crop and no cover crop strips. Error bars represent standard error of the mean at the 95% confidence interval. Asterisk (*) within each date indicates significant difference ($p < 0.10$) between cover crop and no cover crop.

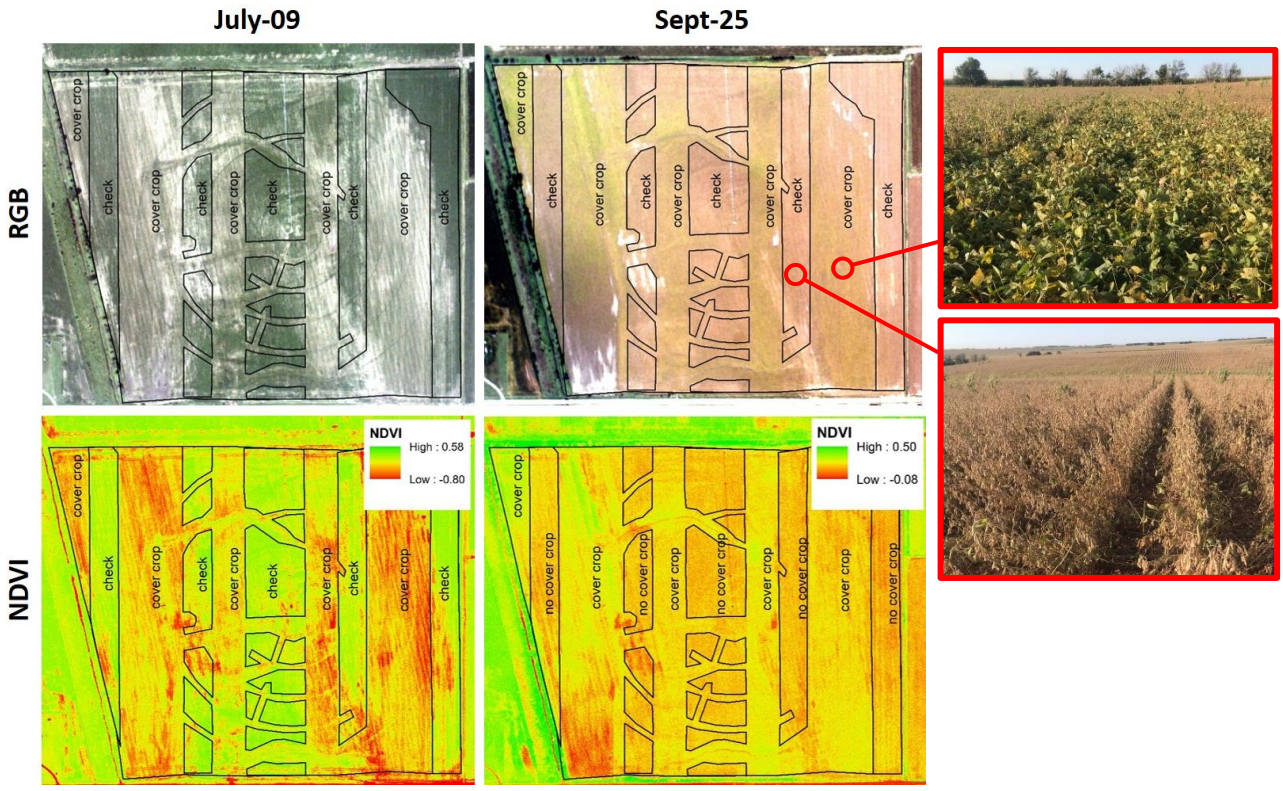

Figure 2. Aerial imagery from July 9 (left) and September 25 (right) displayed as true color (top) and normalized difference vegetation index (NDVI) (bottom). In some areas, such as pivot tracks and vulnerable areas, cover crops were seeded in areas originally designated as check; all areas where cover crops were seeded were included in the cover crop treatment image analysis. These boundaries between cover crop and no cover crop are indicated with black outlines. Far right inset images are pictures taken on September 26 in cover crop and no cover crop treatments.

Table 3. Soybean yield, yield components, oil, moisture, and marginal net return for cover crop mix and no cover crop treatments.

	Pods/ plant	Seeds/ plant	Linoleic (%)	Saturated fat (%)	Protein (%)	Oil (%)	Fiber (%)	Moisture (%)	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
Check	48.5 A	103 A	6.7 A	10.6 A	34.0 A	19.6 A	4.9 A	15.0 A	67.9 A	549.67 A
Cover Crop Mix	49.9 A	107 A	6.6 A	11.1 A	35.1 A	19.2 A	4.8 A	16.8 A	69.5 A	524.69 A
P-Value	0.897	0.771	0.880	0.397	0.385	0.175	0.178	0.210	0.779	0.605

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 13% moisture.
‡Marginal net return based on $8.10/bu soybean, $24/ac cover crop seed, and $14.40 drilling.

Summary:

- Aerial imagery normalized difference vegetation index (NDVI) analysis showed lower values for soybeans following cover crops in July (Figure 2).
- Soybeans following cover crops had lower biomass and were not as canopied as soybeans following no cover crop.
- In September, the soybeans following cover crops had higher NDVI representing soybeans that were not as mature. Soybeans following the no cover crop treatments had greater leaf senescence and were more mature.
- Soil management, soil pore indicator scores, and the overall indicator score were significantly lower for the check than the cover crop treatment.
- The treatments did not result in differences in soybean moisture, yield, or net return.

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