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Nurse Cropping in Potato Systems

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Issue

The time required for potatoes to emerge following planting is longer than any other major crop grown in Maine. During this time, the soil is subject to erosion loss. It would be beneficial to protect the soil during this time period. A nurse crop (NC) could be used to protect soils during this period, but information is needed on the following production decisions: 1) which crop species and sowing rate is optimum; 2) what is the optimum NC production period; and 3) is herbicide necessary to kill the nurse crop prior to incorporation.

Study

In the summer of 2016, a study was conducted at the Rogers Farm in Stillwater, Maine to study the effect of short-term nurse crops on potato yield and quality. The study was designed as a randomized complete block design with six replications. The study compared two sowing rates (winter rye at 100 vs. 200 lbs/ac) to 20 lbs of annual ryegrass or a check plot (no nurse crop). In addition, each of the winter rye treatments was either killed with an herbicide prior to one-pass hilling or just hilled. To address the question of how long to grow a NC, WR treatments were allowed to grow either three weeks or four weeks prior to being incorporated.

Methods

The field study was established on 18 May. The plots were established, and cereal or annual ryegrass seed was broadcast within the appropriate plot areas. A tine cultivator was run through the field to provide some seed to soil contact. Then, a potato planter was used to mark the rows, and 160 lbs/ac 10-10-10 fertilizer was banded in the row. Hand cut Snowden seed was planted by hand at 9 inch spacing, and red chieftain potatoes were planted in the four foot alleyway between plots. Admire was applied in furrow to protect against Colorado potato beetles and other insect pests as the planter was used to cover the seed pieces. Nurse crop treatments were sampled 17 days after planting (DAP) for the 21-day NC production period and at 24 DAP for the 28-day NC production period. Samples were collected using a $1ft^2$ quadrat randomly placed twice within each plot. Samples of above ground biomass were cut with shears, and plants were counted prior to placing in the bag. Rimsulfuron was applied to specific nurse crop treatments at 18 DAP, and 21-day plots were incorporated at 19 DAP due to forecasted rain. Weeds were controlled with metribuzin and metolachlor at labeled rates following hilling, and plants were protected with fungicides weekly. The 28-day plots were treated similarly. Petioles were collected on 17 July and 18 August. The fourth leaflet from the top of the plant was sampled, leaves stripped off, and placed in a paper bag. Samples were ground and analyzed for nitrate. Plants were top killed 1 September 2016 and harvested three weeks later. The potatoes were washed, graded into four size categories, and

sampled for skin surface and internal defect evaluation. Data were analyzed in JMP 11 – contrasts were used to separate treatment differences.

Results

Winter rye sowed at 200 lbs/ac significantly increased plant number and biomass compared to the 100 lbs/ac seeding rate (Figure 1 and Figure 2). Interestingly, the 20 lb/ac annual rye treatment had similar plant numbers but they had significantly lower biomass than either the 100 or 200 lb/ac cereal rye NC treatments. Annual ryegrass should not be recommended for this use as the plant biomass is much slower to develop compared to cereal rye. Delaying incorporation did not significantly increase dry matter production in 2016, likely due to limited soil moisture in early June. We also didn't find any difference in petiole nitrate in either sampling period. This suggests that the WR did not tap into the fertilizer banded in the potato row. It also indicates that WR does not tie up N when it breaks down following one-pass hilling. Potato yields were very low due to the lack of moisture. Delaying incorporation and not killing the nurse crop with an herbicide prior to incorporation led to lower marketable potato yields (10% level of confidence) and total yield at the 0.05% level for the 28-day growth period. The cereal rye nurse crop not killed with herbicide was not completely buried by the hiller and likely competed with the potatoes for water and nutrients, which limited yield. Rimsulfuron effectively killed WR at 27 DAP, and as such, it did not compete with potatoes for limited water.

Discussion

Nurse cropping deserves further attention as a means to protect the soil before potatoes emerge from the soil. It appears as though one can let the NC grow as long as 25 – 30 days without hurting production so long as the NC is killed with an herbicide before 30 DAP; it does not appear to interfere with soil moisture relations, potato growth and development, or tie up fertilizer N. We didn't measure soil moisture, but Gil Moreau found a slight increase in available water for several weeks after incorporation. With the risk of intense precipitation events becoming increasingly common, the time is right to explore measures that might increase cropping system resilience. Looking to next year and beyond, growers have requested that we consider trials with barley in addition to WR. Given the low commodity pricing of barley, growers could grow seed for their own NC use. While they could also grow WR, most growers are familiar with producing barley. In the summer of 2017, we look forward to comparing barley and WR at 100, 200, and 300 lbs/ac seeding rates. I also hope to find some growers interested in trying it in Central Maine production fields.

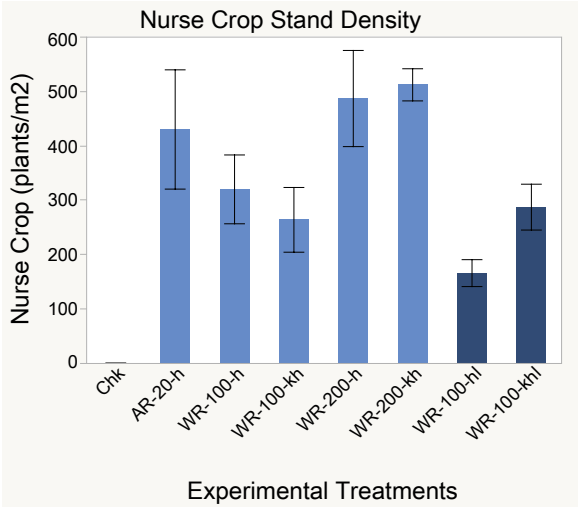

Figure 1. Nurse crop stand density

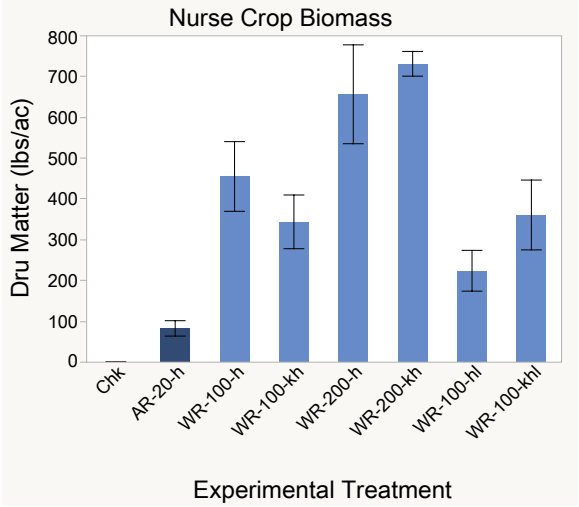

Figure 2. Nurse crop biomass at 17 DAP

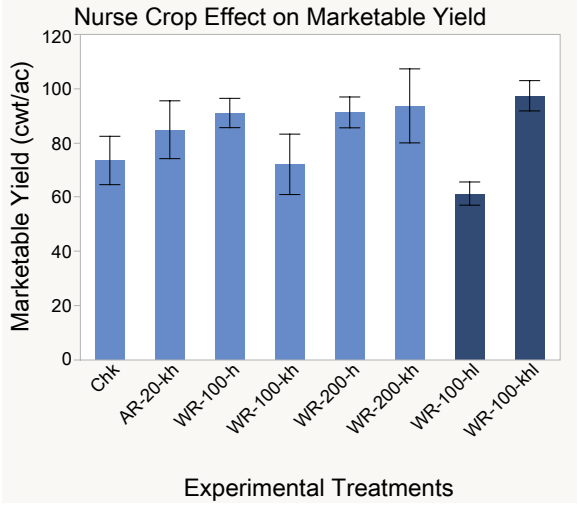

Figure 3. Marketable yield as influenced by nurse crops