Results

0.1 Compaction

Compaction was affected significantly overall by tillage treatments ($H = 38.2$, $df = 2$, $n = 72$, $p = <0.0001$) by ~52.4 % across cover crop treatments (Fig 1a). Tractor-till had the largest significant effect on depth to hardpan compared to no-till ($p_{adj} = <0.0001$), deepening the depth to hardpan by ## cm (conv__, or ~*30-100%*) compared to no-till, down to ~20.6 ± 4.6 cm (8.1 ± 1.8 in) across all cover crop mixes. Roto-till also had a marginally significant effect on depth to hardpan compared to no-till ($p_{adj} = 0.1$), deepening the depth to hardpan by ## cm (conv__, or ~*0-100%*) compared to no-till, down to ~13.8 ± 1.9 cm (5.4 ± 0.7 in). The overall effect from tillage stemmed from significant effects among the perennial ($p_{adj} = <0.01$) and weed suppression ($p_{adj} = <0.01$) mixes (Fig 1a). The effect of roto-till was more pronounced in the perennial mix ($p_{adj} = <0.01$), where depth to hardpan was about twice as deep as in no-till plots (Fig 1a). There was also a significant difference of ### (conv__, or ~*33%*) between tractor- and roto-till among all cover crop mixes (Fig 1a).

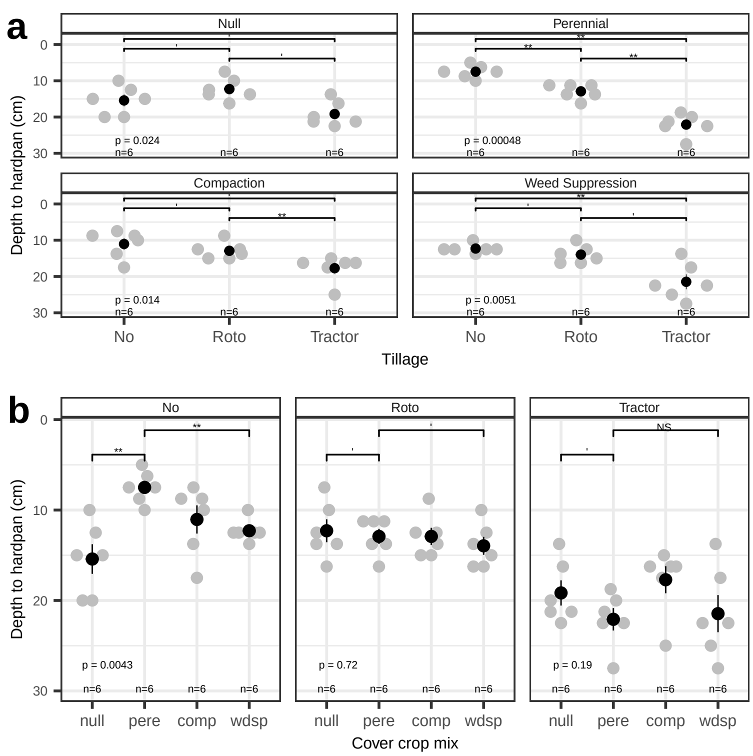

Figure 1: Compaction data (a) , and (b). Gray dots show plot medians and black point ranges show group mean ± 1 std err. Significant pairwise post-hoc Wilcoxon test outcomes shown (**** p < 0.0001, *** p < 0.001, ** p < 0.01, * p < 0.05, *' p < 0.1, ' p > 0.1)

Compaction was not affected by cover crops among tillage groups overall ($H = 2$, $df = 3$, $n = 72$, $p = 0.57$), but was significantly affected by cover crops specifically under no-till conditions ($df = 3$, $n = 6$, $p_{adj} = <0.01$) (Fig 1b). Under no-till, the perennial mix had significantly shallower depth to hardpan compared to both null (p_{adj} = *<0.01*) and weed suppression mixes (p_{adj} = *<0.01*), raising the depth to hardpan by ~*5* cm (2, or ~*30-100%*) compared to each mix, up to ~12.5 ± 7.4 cm (4.9 ± 2.9 in) below the soil surface (Fig 1b).

0.2 Infiltration

Soil infiltration was significantly affected by tillage ($H = 8.5$, $df = 2$, $n = 48$, $p = 0.01$) but not cover crop mix ($H = 5.9$, $df = 3$, $n = 48$, $p = 0.1$) (Fig 2). Roto-till had significantly faster infiltration compared to no-till ($p_{adj} = 0.027$) and marginally significantly compared to tractor-till ($p_{adj} = 0.1$), speeding up infiltration by ~14.5 % compared to each tillage groups, up to ~ 13.4 ± 10.7 mL per sec (0.2 ± 0.2 gal per min) (Fig 2a).

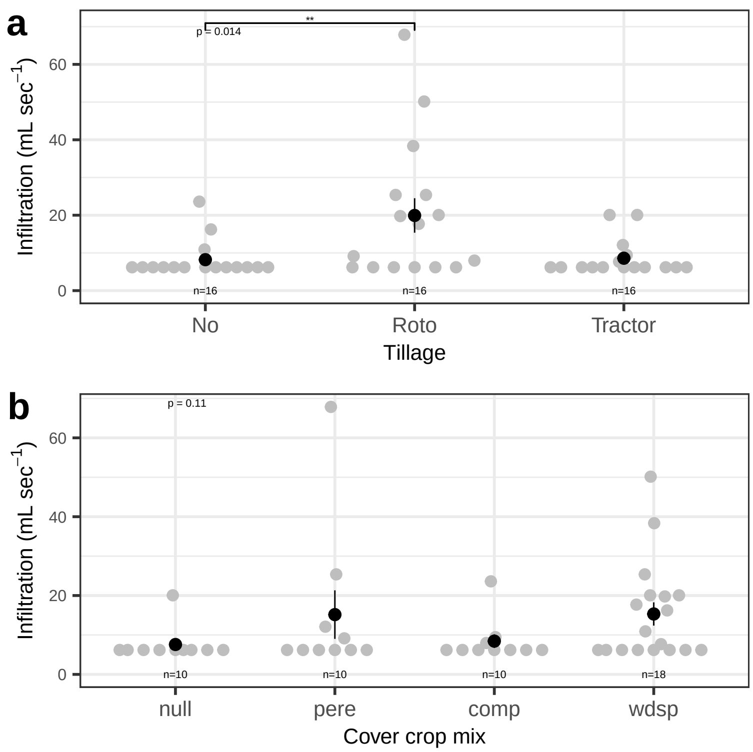

Figure 2: Infiltration data (a) , and (b). Gray dots show plot medians and black point ranges show group mean ± 1 std err. Significant pairwise post-hoc Wilcoxon test outcomes shown (**** p < 0.0001, *** p < 0.001, ** p < 0.01, * p < 0.05, *' p < 0.1, ' p > 0.1)

0.3 Weed pressure

Weed density was overall marginally significantly affected by tillage ($H = 6.5$, $df = 2$, $n = 72$, $p = 0.039$) by ~25.1 %, although weed cover ($H = 0.2$, $df = 2$, $n = 36$, $p = 0.92$) and richness ($H = 1.6$, $df = 2$, $n = 72$, $p = 0.44$) were not (Fig 3a). Weeds under tractor-till were marginally significantly denser compared to no-till ($p_{adj} = 0.1$) and roto-till ($p_{adj} = 0.1$), denser by ~6.5 % compared to each tillage group, up to ~ 0.8 ± 0.2 *stems per m*$^{-2}$.

All measured weed variables were affected significantly by cover crop mix, including weed density ($H = 20.1$, $df = 3$, $n = 72$, $p = 0.00016$) changing overall by ~6.5 %, weed cover ($H = 10$, $df = 3$, $n = 36$, $p = 0.019$) changing overall by ~-5.5 %, and weed richness ($H = 31$, $df = 3$, $n = 72$, $p = <0.0001$) changing

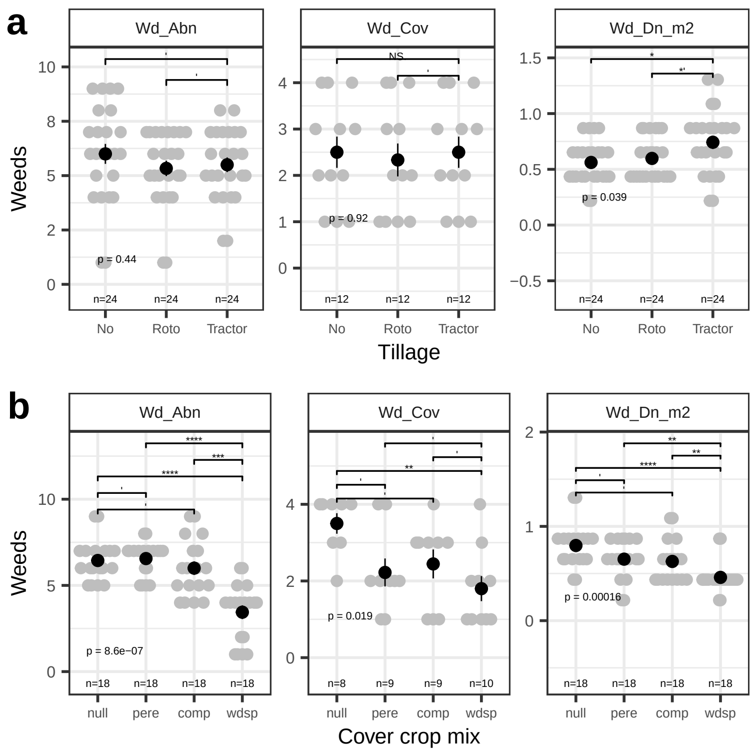

Figure 3: Weeds data (a) , and (b). Gray dots show plot medians and black point ranges show group mean ± 1 std err. Significant pairwise post-hoc Wilcoxon test outcomes shown (**** p < 0.0001, *** p < 0.001, ** p < 0.01, * p < 0.05, *' p < 0.1, ' p > 0.1)

overall by ~-0.5 % (Fig 3b). Weeds in the null mix covered significantly more plot area compared to the weed suppression mix (p_{adj} = 0.03) and marginally significantly compared to perennial (p_{adj} = 0.1) and compaction (p_{adj} = 0.2) mixes, up to ~ 4 ± 0 %. The null mix also had marginally significantly higher weed density compared to the weed suppression mix (p_{adj} = 2e-04) and marginally significantly compared to perennial (p_{adj} = 0.2) and compaction (p_{adj} = 0.1) mixes, up to ~ 0.9 ± 0.3 *stems per m*$^{-2}$. The weed suppression mix had the most detectable effects on both weed density and richness. The weed suppression mix significantly lowered weed density compared to all other cover crop mix treatments, namely the null (p_{adj} = 2e-04), perennial (p_{adj} = 0), and compaction (p_{adj} = 0.7) mixes, by ~ ## +- ## (conv_, or %%%), down to ~ 0.4 ± 0 *stems per m*$^{-2}$. The weed suppression mix also significantly lowered weed richness compared to all other cover crop mix treatments, namely the null (p_{adj} = <0.0001), perennial (p_{adj} = <0.0001), and compaction (p_{adj} = 0.00093) mixes, by ~ ## +- ## (conv_, or %%%), down to ~ 4 ± 1.5 taxa .

0.4 Yield

Radish yield was not significantly affected by tillage ($H = 1.4$, $df = 2$, $n = 8$, $p = 0.5$), and centered at ~ 13.2 ± 1.5 *kg m*$^{-2}$ (29.1 ± 3.3 *lbs m*$^{-2}$) and ~ 0.1 cm (0 in) long (Fig 4).

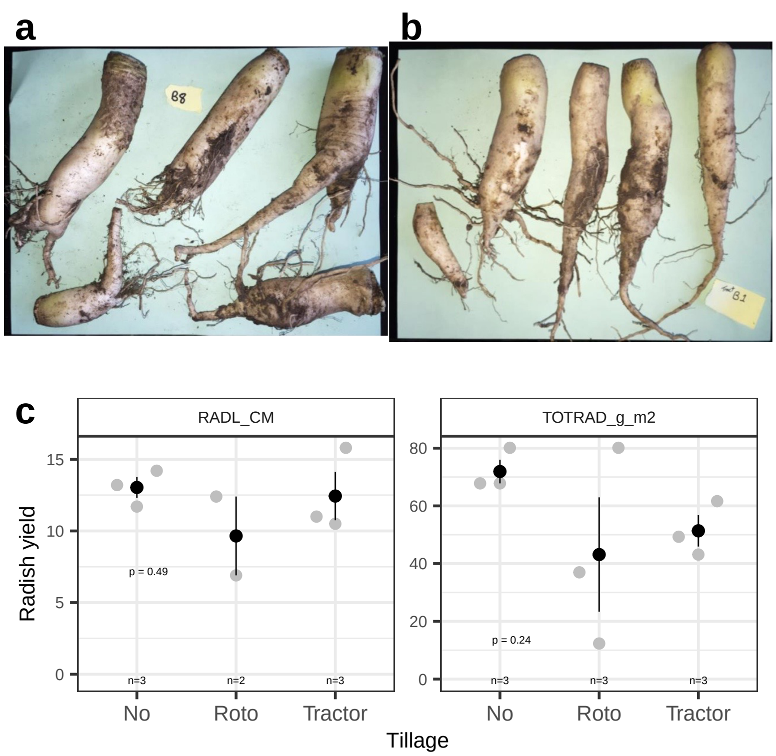

Figure 4: Yield data (a) from no-till and (b) tractor-till. Gray dots show plot medians and black point ranges show group mean ± 1 std err. Photo credits: Naim Edwards.