MORISHITA, DON W.*, KELLI M. BELMONT, ERIK J. WENNINGER, and W. HOWARD NEIBLING, University of Idaho, Kimberly Research and Extension Center, 3806 N. 3600 E., Kimberly, ID 83341. **Irrigation, tillage system, and fertilizer rate on weeds, insects and diseases in sugar beet.**

The amount of tillage, irrigation and nitrogen fertilizer applied in a cropping system has been shown to influence pest populations and diversity. Strip tillage and direct seeding sugar beet became economically viable after Roundup Ready technology became available to sugar beet growers. However, the interactive effects of fertilizer application rates, irrigation amounts, and tillage level on the incidence and management of insects, disease and weeds in sugar beet is not clearly understood. It is known that reducing tillage can reduce operating costs as well as reduce early-season soil water loss by evaporation. Plus, stand loss due to wind can be reduced with more residue from the previous crop available to protect fragile sugar beet seedlings. A field study was conducted in 2013 and 2014 to determine the effect of irrigation amount, nitrogen fertilizer rate, and level of tillage on weeds, insects and diseases in sugar beet. Three tillage treatments were established: conventional tillage (CT), strip tillage (ST), and direct seeding (DS). Conventional tillage consisted of fall chisel plowing and disking, followed by spring disking and roller harrowing. The ST treatment was performed by fall tillage with an Orthman 4-row strip tillage implement. The DS treatment was not tilled at all. Irrigation treatments, based on sugar beet evapotranspiration (ET) were established at: 50, 100, and 150% of ET. A solid set plot sprinkler system was designed and used for the irrigation treatments. Four nitrogen (N) fertility rates were applied: 60, 80, 100, and 120% of recommended N for CT sugar beet. Experimental design was a split block split plot randomized complete block design with tillage as the main plot, irrigation as the sub-plot, and fertilizer rate as the sub-sub-plot. Weed seedling emergence counts were made within fixed 0.125 $m^2$ areas, established within the row and between the row, in each sub-sub plot four times. Glyphosate was applied at the 2-leaf crop stage at 0.84 kg/ha and again 15 days later in combination with dimethenamid-P at 0.95 kg/ha. When looking at weed populations, there were more total weeds between the rows in the CT and DS than ST at the early weed counts. However, by the middle of the spray season, there were more total weeds between the rows in the CT than DS and ST. This is likely due to the lack of soil disturbance in the DS and ST. In response to irrigation, there tended to be more weeds in the highest irrigation rate compared to the lowest. Nitrogen rate applied did influence the weed densities, with 125% N having the lowest weed densities. Regarding the insects, where there were differences in leafminer numbers, there were more in CT than ST or DS. The same was true for black bean aphid numbers, i.e. there were more in CT when there were difference. This may be attributed to the color contrast between the beet leaves and the soil surface. In the CT where there was less crop residue, the color contrast may have made it easier for flying adult leafminers to find plants than in the ST or DS. Although there was a significant difference in black bean aphid numbers in response to nitrogen rate, it did not correlate well with nitrogen rate. The differences in populations appeared to be random. Sugar beet root aphid did not respond to irrigation or N rates. Random *Aphanomyces* and *Rhizoctonia* diseased plants were found throughout the study site, but there was no correlation with tillage, irrigation or nitrogen fertilizer rates. Sugar beet root yield averaged across the two years of this study and pooled across irrigation and nitrogen rate were about 8% lower with DS compared to CT or ST. However, estimated recoverable sucrose yields were equal between tillage treatments averaged over years and pooled across irrigation and nitrogen rate. Direct seed sugar beet production looks promising with the availability of the Roundup Ready Technology.