

Irrigation system evaluation

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Date: February 24, 2021; **Nursery:** Altman Plants; **Address:** 2575 Olive Hill Rd, Fallbrook

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Summary

On February 1st, 2021 I visited the nursery with Mr. Carlos Camacho and on February 24, I performed an irrigation system evaluation on field A30 in zone 4 (north) with the help of Mr. Javier Lopez and of Mr. Pedro Aviña.

We installed Schrader valves to be used as pressure check points and we trained the technicians on how to install them. We recommend that growers and irrigators are trained and able to install Schrader valves and to check pressure. We recommend buying drills, taps to cut threads in PVC pipe, Teflon tape and pressure gages. Uniformity of pressure distribution and consistent pressure across irrigation events is essential to achieve good distribution uniformity.

The pressures measured at valve 4 in the field A30 are within the range of pressure recommended for the sprinkler heads used, Hunter PGP Ultra (25 to 65 psi). However, there is high variability between different valves (e.g. we measured 40 psi at valve 3 and 27 psi at valve 4) and this strongly affects distribution uniformity. Additionally, at the farthest sprinkler head in valve 3 we measured 21 psi that is a pressure lower than recommended by the manufacturer.

The sprinkler heads were Hunter model PGP Ultra with 4 gpm nozzles. Some 6 gpm nozzles were also found. These sprinkler heads have interchangeable nozzles that determine flowrate and radius. They also have adjustable nozzle screws that allow reduction of the radius up to 25%. We recommend selecting an adequate nozzle to achieve a radius equal to the current spacing between sprinkle heads. The spacing is 30 ft x 30 ft and we recommend nozzles of 1.5 gpm (see table below from the Hunter website). We also recommend to train irrigators on the function of the nozzle screw: the screw is used to slightly reduce the radius, not to spread the sprinkler spray and should not be changed with different crops.

We recommend considering installing pressure regulators at each valve or, even better, at each sprinkler head. Always remember that pressure regulators only reduce pressure, they do not increase it. Hunter PGP Ultra sprinklers are recommended for 45 psi so we recommend 50 psi regulators at the valves or 45 psi regulators at the heads. Make sure the pressure regulators that are selected can handle the right flowrate, for example: each valve serves about 30 sprinklers, with 4 gpm nozzles the flowrate through the valve is 120 gpm. If pressure regulators are installed at the valve, they should be able to handle 120 gpm. If 1.5 gpm nozzles are installed, the flowrate through the valve will be only 45 gpm.

During the evaluation, an irrigator manually opened one valve to irrigate an additional period of time beyond what programmed by Edgar and by the growers. This practice is problematic because leads to water applications uncontrollable by the growers and the head grower. Irrigators could be trained to strictly follow grower decisions. Maybe flowmeters could be installed in specific points of the irrigation system to measure how much water was really applied and use this as a training tool.

March 2021 update:

Additional visits were performed on 3/5, 3/12 and 3/18 to install a 2-inch flowmeter on valve 4 of the field A30. The flowmeter was equipped with a data logger and cellular modem and Mr. Javier was trained to download the data.

Also, additional pressure check points were installed at the injector house on the main line that is the source of water serving fields A30, A31, A32, A33, A34 and A35. Additional pressure check points were installed on field A33 while training Edgar on how to install them. At the injector, pressure is very variable depending on what other fields are being irrigated in the nursery and ranged from 42 psi to 100 psi. This extreme variability should be avoided. We recommend that the irrigation of different fields in the nursery is programmed in a centralized manner so that the area irrigated at the same time is more or less constant and the pressure is adequate. Also, the turning on of the additional pumps from the retention/recycling basin increases the pressure should be programmed according to the nursery-wide irrigation schedule.

General recommendations:

1. Pressure in field A30 is very variable, from 21 to 40 psi. The sprinkler heads Hunter PGP Ultra have a recommended pressure range of between 25 and 65 psi and the recommended pressure is 45 psi. We recommend that the pressure is 45 psi or close at all sprinkler heads. To increase the pressure, we recommend reduce the quantity of irrigation blocks irrigated at the same time and/or reduce the nozzle size (see next recommendation).



Figure 1. The Head Grower measuring pressure

2. The distance between sprinkler heads measured in the field A30 is 30 ft x 30 ft. The nozzles currently installed are 4 gpm nozzles (the number is printed on the nozzle, see figure 6). These nozzles, at pressures between 25 and 45psi, give a radius of 37 to 40 ft (see table below). We recommend installing 1.5 gpm nozzles that give a radius between 29 and 31 ft. The smaller nozzles also apply smaller flowrates and the differences in pressure in the field also will reduce. However, with the smaller nozzles, the precipitation rate will also be smaller so the irrigation event duration will have to increase to apply the same amount of water. Nevertheless, the distribution uniformity will increase. Training may be required for the irrigators since the smaller nozzles will appear to apply a smaller quantity of water and probably will be less visually satisfying.

PGP BLUE NOZZLE PERFORMANCE DATA					
Nozzle	Pressure PSI	Radius ft.	Flow GPM	Precip in/hr	
				■	▲
1.5 ● Blue	25	29	1.2	0.27	0.32
	35	31	1.4	0.28	0.32
	45	31	1.5	0.30	0.35
	55	32	1.8	0.34	0.39
	65	32	1.9	0.36	0.41
2.0 ● Blue	25	33	1.4	0.25	0.29
	35	33	1.7	0.30	0.35
	45	34	2.0	0.33	0.38
	55	34	2.1	0.35	0.40
2.5 ● Blue	25	33	1.7	0.30	0.35
	35	35	2.1	0.33	0.38
	45	35	2.5	0.39	0.45
	55	35	2.6	0.41	0.47
3.0 ● Blue	25	35	2.2	0.35	0.40
	35	36	2.7	0.40	0.46
	45	38	3.0	0.40	0.46
	55	39	3.4	0.43	0.50
4.0 ● Blue	25	37	3.0	0.42	0.49
	35	39	3.5	0.44	0.51
	45	40	4.0	0.48	0.56
	55	41	4.5	0.52	0.60
	65	41	4.8	0.55	0.63

Figure 2. Specifications for sprinkler heads Hunter PGP Ultra. The circles indicate the 1.5 gpm and 4 gpm nozzle radius. Each line gives the flowrate and the radius of each nozzle at different pressures, from 25 to 65 psi. The 45 psi line is bold because 45 psi is the pressure recommended by the manufacturer.

3. The 4 gpm nozzles currently installed give radii of 40 ft that is too much for the current spacing of 30 ft by 30 ft. It seems that the irrigators adjusted the nozzle screws screwing them all the way down (see picture), to reduce the radius and obtain a more spread spray pattern. It is recommended to install 1.5 gpm nozzles (see recommendation #2) and to unscrew the nozzle screw until a 30 ft radius is obtained. In other words, the water from one sprinkler head should reach the adjacent sprinkler head (head-to-head irrigation). We recommend training the irrigators, so they understand that the screws adjustment depends on nozzle and sprinkler spacing and that the screws don't need adjustment when the crop changes.



Figure 3. To reduce the radius, the nozzle screw was adjusted all the way in.

4. Make sure that all sprinkler heads are the same brand and model within an irrigation block and have the same nozzle. This is extremely important, since mixing different nozzles or sprinkler models reduces distribution uniformity drastically.



Figure 4. Different nozzles installed (see number 4 and 6 printed on the nozzle).

- We found evidence of plant disease in the nursery. Increasing distribution uniformity may decrease the incidence of diseases and we recommend sanitation practices. Additionally, we recommend the free diagnostic service offered by Dr. Del Castillo at UC Davis that specializes in pathology in ornamentals.
<https://greenhousepathology.faculty.ucdavis.edu/2020/01/25/extension/>
Finally, we recommend against pumping runoff water from the retention pond without treatment. This practice could lead to recycling plant diseases, particularly those caused by water molds (oomycetes) such as Phytophthora and Phytium. Techniques such as chlorination, ozonation and slow sand filters are commonly used to treat irrigation runoff before recycling it.

Recommendations to enable growers and irrigators to measure pressure:

- Buy Schrader valves with 1/8" NPT threads. Link below:
<https://www.amazon.com/Milton-684-NPT-Tank-Valve/dp/B001O2ZL5C/>
- Buy a 1/8" NPT tap and drill bit to install Schrader valves in PVC pipes.
<https://www.amazon.com/Century-Drill-Tool-93201-Combo/dp/B0797JWQ1R/>
- Buy battery-powered drills.
- Buy pressure gauges. We recommend high quality digital pressure gauges such as Dwyer DPGW-08
<https://www.amazon.com/Dwyer-Digital-Pressure-Liquids-Compatible/dp/B008HOWUTO>
- Each pressure gauge needs a ball chuck and Teflon tape
<https://www.amazon.com/Tru-Flate-17-351-Female-Direct-Shut-off/dp/B000H5OMOS/>
<https://www.amazon.com/Millrose-Available-Mill-Rose-70886-1429-Inches/dp/B009YA0YBW/>



Figure 5. Equipment recommended to measure pressure

Recommendations to improve distribution uniformity between different valves:

To improve uniformity of pressure between different valves within the same field, pressure regulators can be installed at each valve, so they will decrease the pressure to a set amount, regardless of the pressure delivered to the valve. The Hunter PGP Ultra sprinkler heads are recommended for 45 psi so a 50 psi pressure regulator at the valve seems adequate. Senninger produces pressure regulators that are designed to a specific pressure with no adjustment required. The model PRU handles up to 100 gpm, that would probably be adequate for most irrigation blocks if the sprinklers nozzles are changed to 1.5 gpm.

It is important to remember that pressure regulators only reduce pressure, they do not increase it. So, for the pressure regulators to equalize pressure between different valves, the pressure delivered at the valves must be 50 psi or above. Again, it is important that the area irrigated at any time is adequate for the pumps running, or else the pressure at the valves will drop.



Figure 6. Pressure regulator example

Recommendations to monitor irrigation water:

In irrigation management, it is common that irrigators irrigate more than what is needed. This is observed in many crops and in many parts of the world, even when irrigation water is expensive. We recommend training irrigators on the importance and costs of irrigation water. For example, one could explain how much money is spent irrigating one acre for one hour:

The cost of municipal water in northern San Diego county is about \$2500 per AcFt. If these costs are the same for this nursery, then one AcIn costs ($\$2500:12=$) \$208. The current application rate is about 0.25 in/hr. So, one irrigator irrigating a one-acre block for one hour, applies about 0.25 AcIn of water or about \$50.

Also, we recommend that the data produced by the flowmeter recently installed is analyzed at the end of each day and compared to the automatic program made by Edgar to make sure there were no additional irrigation applied. This could be used as a training tool.