The Effects of Agricultural Practices in the Imperial Valley

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Acknowledgments

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Executive Summary

My project was set in my hometown, the Imperial Valley, where agriculture dominates the region with the estimated farmable acres in 2015 being approximately 480,000. (Editor). Of these acres approximately 32,000 are certified organic. (Diaz). Because of this, naturally, my internship revolved around agriculture. To tie this in with my major, Environmental Science, I set out to focus on how agricultural practices impact our environment. I focused on where the water that is used to irrigate crops goes after leaving these fields as well as the environmental impacts of agricultural practices rather than focusing on the crops themselves. In the Imperial Valley, our watershed is the Salton Sea, an ecosystem that is severely contaminated by agricultural runoff, drainage and sewage. The salinity, selenium and nutrient levels of the salton sea have caused mass fish die offs and total destruction to the once thriving ecosystem. However, although this runoff also feeds the sea and keeps water levels constant, the contents of the runoff harshly affect the ecosystem.

My main focus became to study the impact of different forms of farming (organic vs. conventional) on our watershed. At a research level, crop production is done at a significantly smaller scale than that of commercial growing. Because of this, we have more control over irrigation and can minimize runoff to nearly nothing at all. In commercial production, there is much less control over the amount of runoff, as irrigation becomes much more complex when watering multiple acres of land at a time. Due to this amount of control over water, we did not produce much runoff. Rather than collecting water samples from runoff, we collected samples from water pressure gauges.

As the water allocated to the Imperial Valley travels through many destinations before reaching us, it is very saline upon arrival. Prior to entering the the field, the canal water had a conductivity of 1.2 mS/cm and nitrogen levels of 1.2 mg/L. Farmers don't always use recommended amounts of water or fertilizers as applying the perfect amount is difficult to do at a large scale. In our trials, water and fertilizer were applied in variable amounts which mimics the reality of farming practices. Flood systems are ideal to use in the Imperial Valley due to the salinity of water. Salinity is flushed through drainage and leaves to the salton sea. In organic and conventional farming we see differences in plant and soil nutrients and quality of drainage.

A great part of my internship was spent with outreach programs as well. The research center where I was stationed is unique by the fact that both research and outreach is occurring at the same time. I was often able to work with the youth of my community and speak about Sustainability and how to minimize human impact on the environment. I was able to share some of my research with a group of students attending a 4-H sustainability camp. This camp exhibited a field trip to the New River Wetlands where I was able to speak to the campers about water pollution and the importance of sustaining our fresh water.

Project Objectives

The purpose of these projects was to view the impact of varying amounts of water and fertilizer on crops. The difference in yields would be recorded as well as the quality of the water from each treatment. With the collected data I was able to gain insight on the environmental impact of organic vs. conventional vegetable management at the farming scale. The crops stood as a representation of the typical commercial practices. Fertilizers and pesticides were applied as they are in large-scale farming.

A goal of the project was to learn how to utilize tools to obtain data. These tools included a greenseeker, which reads foliage levels of crops, water meters, pressure gauges, watermark tensiometers and lab equipment. Each tool was utilized to track the progress of the crops and to deliver insight on crop activity. This information allowed us to make decisions regarding what should be applied to the crop such as how much water or how much fertilizer.

Outreach was focused on educating youth on sustainable water use practices. Watershed management would be discussed and wetlands education would be conducted. Engaging youth on sustainability was a large goal during the one week long sustainability camp. Multiple opportunities led me to speak about water as a resource and actions that can be taken to conserve this resource. I also found myself in the position to expand my learning in agriculture and mentor high school students through Farm Smart.

Project Approach

The water quality data from the two methods, conventional and organic, of crop production provides insight on what type of runoff and drainage each method of farming produces. With this information it can be predicted what type of impact each method of farming has on our watershed, the Salton Sea. By knowing how much fertilizer we were applying and analyzing the soil and water contents of the field, it was seen how the nutrients in the fertilizer are distributed. The data showed how much nutrients the crops absorbed and how much was contained in runoff or drainage.

The amount of water needed by a crop can be calculated as well as the amount of fertilizer required. However, the theoretical amounts are rarely, if ever, applied . These amounts vary due to difficulty of applying perfect amounts each time. By applying different percentages of the calculated water and fertilizer needed, we were able to mimic more realistically what is applied to large scale crops. To track water quality, we inserted water pressure gauges at different depths into the ground. From the conventional crop, water samples were taken once a month from depths of 6", 12", 24" and 36" below the crop beds. Water samples were taken from the organic crop twice a month from depths measuring 12" and 24" below the crop beds. The samples from these different depths revealed the quality of the water that percolates into the land at different stages. The amount of nitrates and conductivity were analyzed from these samples. This would deliver insight on the quality of the water that is being drained from the field.

To successfully become actively involved with community outreach, I attended outreach programs sponsored or participated in by Farm Smart. These programs would challenge me by focusing on different topics which required me to do further research in order to deliver facts to my community as effectively as possible. These activities included day camps and week long programs.

Project Outcomes

I. Water quality results of conventional onion trial

Conventional- Onions						
Treatment	Conductivity mS/cm			Nitrates mg/L		
	Highest	Lowest	Average	Highest	Lowest	Average
Drip 70% 6"	3.49	2.72	3.13	261.8	12.4	102.24
Drip 70% 12"	6.92	3.37	4.38	202.8	14	85.43
Drip 70% 24"	5.79	4.75	5.3	80.1	38.7	60.3
Drip 70% 36"	9.62	6.77	7.58	233.5	70.9	129.44
Drip 100% 6"	3.2	2.23	2.69	9.3	7.3	8.37
Drip 100% 12"	4.93	3.21	3.85	315.7	52.3	160.06
Drip 100% 24"	3.52	2.02	3.03	94.7	23.8	52.98
Drip 100% 36"	4.54	4.17	4.35	64.2	40.9	50.26
Flood 100% 6"	3.55	2.75	3.02	70	5.5	24.9
Flood 100% 12"	4.72	2.93	3.46	184.9	5.6	86.86
Flood 100% 24"	3.92	2.16	3.13	133.7	14.7	59.8
Flood 100% 36"	3.21	2.73	3.56	72.1	18.2	48.75
Drip 130% 6"	3.15	2.3	2.75	151.8	3.8	43.25
Drip 130% 12"	5.98	4.89	5.44	125.2	22.4	59.98
Drip 130% 24"	6.17	2.48	4.89	101.3	16	62.24
Drip 130% 36"	11.04	5.37	8.74	729	51	275.22
Canal	1.09	0.93	1.03	-	-	1.2

II. Water quality results of organic zucchini trial

Organic- Zucchinis						
Treatment	**Conductivity mS/cm**			**Nitrates mg/L**		
	Highest	**Lowest**	**Average**	**Highest**	**Lowest**	**Average**
Fertilizer 50% 12"	3.4	2.69	2.97	8.06	3.5	6.02
Fertilizer 50% 24"	5.44	2.67	4.51	16.4	9.2	11.63
Fertilizer 100% 12"	2.31	2.1	2.24	15.3	3.1	10.53
Fertilizer 100% 24"	5.4	2.92	4.56	9	4.8	7.07
Fertilizer 200% 12"	2.8	1.58	2.29	25.4	4	12.83
Fertilizer 200% 24"	4.2	2.33	3.36	33.3	2.09	14.26
Canal	-	-	1.1	8.5	2.09	5.3

The data presented in each table reveals nitrogen and conductivity levels of each sample of water from a different crop bed. The highest, lowest, and average levels are recorded.

Conclusions

The different depths of samples reveal the quality of water that is percolating towards the drains. The deepest level is nearest to the drain and gives insight on the water quality of the drainage. In the average values, it is noted that the conductivity levels increase with depth in both cases.This is because the water leaches to drains and salts begin building up at deeper depths; salinity is from the water not the fertilizer.

Nitrates vary greatly between conventional fertilizer and organic fertilizer. In the conventional fertilizer we see 32% Nitrogen in the solution and 200 lbs per acre was applied. The organic fertilizer contains much lower concentrations of Nitrogen with the solution used containing 3% Nitrogen. Only 20-40 lbs of fertilizer was applied per acre.

Yield analysis revealed that the amount of nitrogen applied to each crop did not change the output. However, more fertilizer leeches into drains when a greater amount is applied. Conventional crops delivered values of nitrogen that often appeared in over 100 mg/L while the organic crop produced no value greater than 33.3 mg/L. The organic crop produced much lower concentrations of nitrogen even when twice the recommended amount was applied.

As my hours often did not coincide with my mentor's hours, my research opportunities were limited. Because of this,, I spent a great amount of my time with Farm Smart, the outreach branch of the Extension Center. I was able to work with kids of all ages and speak to them about water and about the importance of sustainability. This form of outreach was very valuable to me because I was teaching young children about facts that I did not learn until my late teen years. I was able to watch these children expand their knowledge and develop ideas about the environment before my eyes. There were high school interns serving their internships during my time at the Center as well and I was able to mentor them as they each had some level of interest in the environment.

Appendices

References

Diaz, Jairo. Personal Interview. Desert Research Director, UC Cooperative Extension. Imperial Valley, California. June 2017.

Editor, Page. "2015 Imperial County Agricultural Crop and Livestock Report." The Desert Review. N.p., 02 Oct. 2016. Web. 26 June 2017.