GLOBE ABSTRACT
Student Research Report

Burning Beyond The Soil? (A study conducted to analyze soil around a burn pile)
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Environmental Management

The purpose of this project was to use GLOBE protocols to analyze the soil composition in and around a burn pile for pH levels, moisture, Phosphorus, Nitrogen, and Potash. It was predicted that the chemical composition of the soil tested from three different bands around a burn pile would have varying levels for the components tested.

Five soil samples were collected from three different bands around a burn pile, center, mid-way out, and the outer edge and taken to the middle school science lab for testing. Digital meters for pH, moisture, and fertility along with chemical tests for P, N, and K were used. The meters were placed in the soil samples for analysis. Then, 140grams of each soil was measured out with 250ml of distilled water added, let set overnight, then chemical analysis was conducted in the science lab.

Average pH inner soil samples=5.68, middle=6.28, outer samples=6.88. Average moisture inner=1.96, middle=6.08, outer=2.54. Average fertility inner=4.4, middle=4.6, outer samples=0.8. Fertility cross-referenced results: Nitrogen and Potash inner=119ppm, middle=113ppm, outer=20ppm; Phosphorus inner=8.8ppm, middle=9.2ppm, and outer=1.6ppm. Chemical Tests Results: All were negative for oil; Nitrogen inner=3.2ppm, middle=3.6ppm, and outer samples=1.8ppm; Phosphorus inner=2.2ppm, middle=2.2ppm, outer=2.0ppm; Potash= inner=1.8ppm, middle=2.6ppm, outer =2.4ppm.

The middle band samples from the burn pile had the most different levels compared to the inner and outer bands. The middle band had the highest moisture reading, and fertility reading from the digital meters. Chemical soil test results also indicated that the middle band had the highest readings for Nitrogen, Phosphorus, and Potash.

Burning Beyond the Soil

(A study conducted to analyze the effects of burn piles on soil)

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GLOBE Environmental Management

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INTRODUCTION

In rural Ozark communities, it is not uncommon for people to burn trash, yard waste, and left over construction materials in burn piles. During dry times, burn bans are issued in order to prevent accidental fires which could be started from burn piles. The researcher read many articles on the internet about the effects of burn piles on soil. In one article on soil contamination from burn piles, the author states, "Fire affects nutrient cycling and the physical, chemical, and biological properties of soils." The fire can release toxic chemicals that goes into the ground and when it goes in the ground it can be bad for plants and animals. The researcher also accessed the GLOBE website in order to check the GLOBE protocols for testing soil.

PURPOSE

The purpose of this project was to use GLOBE protocols to analyze the soil composition in and around a burn pile located on the school campus according to the pH levels, moisture content, Phosphorus (P), Nitrogen (N), and Potash (K) levels.

QUESTION

The research question being addressed in this project is, "When trash, yard debris and left over building materials are burned in a burn pile, how does it affect the chemical composition of the surrounding soil according to the pH levels, moisture content, Phosphorus (P), Nitrogen (N), and Potash (K) levels.?"

HYPOTHESIS

It was predicted that the chemical composition of the soil tested from three different bands around a burn pile would have varying levels of pH, Moisture, and Fertility based on levels of Phosphorus (P), Nitrogen (N), and Potash (K).

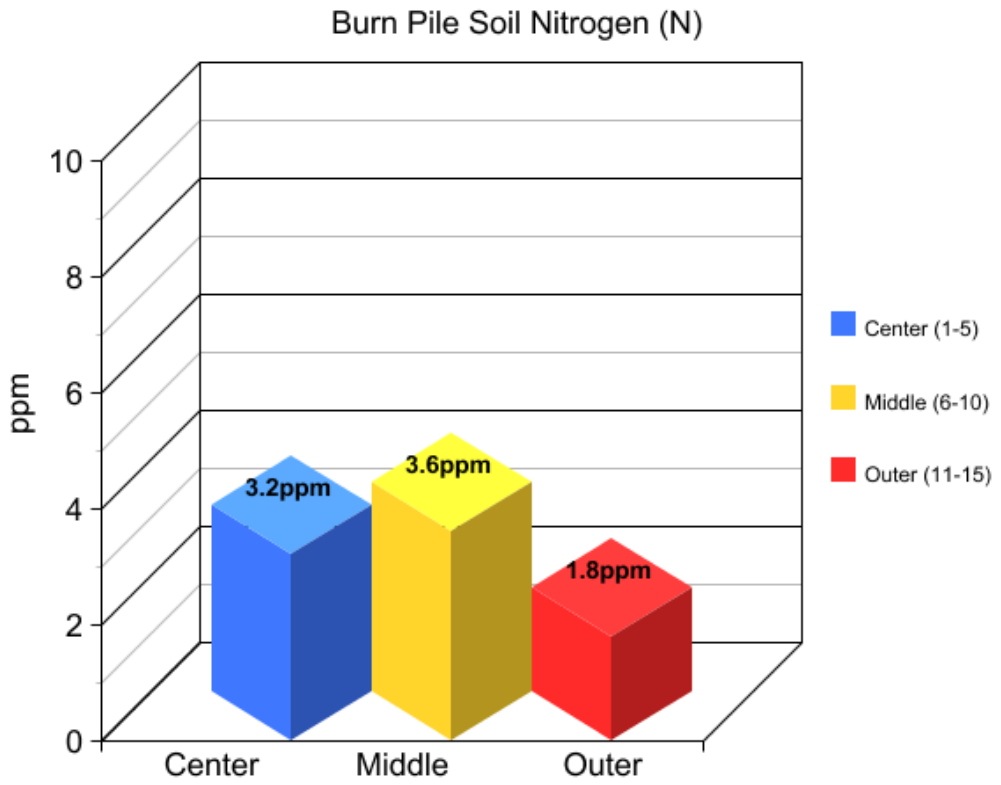
METHODS & MATERIALS

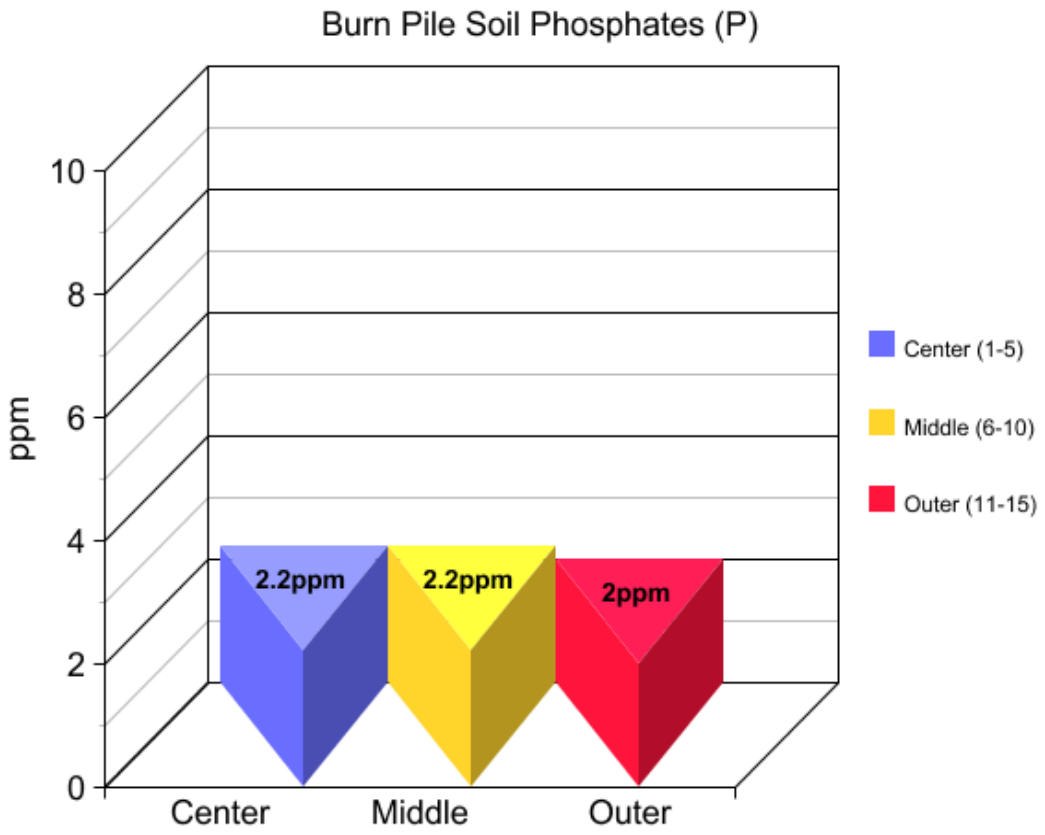
Soil samples were collected from three different bands around a burn pile, center, mid-way out, and around the outer edge. Five samples were collected from each band and placed into sealed plastic bags. The soil samples were then taken to the middle school science lab where they were analyzed, using a digital soil test meter, for pH, moisture, and Fertility. The fertility scale had a cross-reference guide which gave approximate numbers for levels of Phosphorus, Nitrogen, and Potash levels. The digital meters were placed into the soil and the readings for pH, Moisture, and fertility were recorded. A chemical soil test kit was also used to analyze the soil samples for Phosphorus, Nitrogen, and Potash levels. In order to test the soil with the chemical soil test kit, 140grams of each soil was measured on a digital balance scale, and placed into plastic containers. 250ml of distilled water was added to each continuer of soil. The soil was thoroughly mixed with the water and it was left to set overnight. The next day, a plastic pipette was used to collect water from each soil sample. Then, according to the instructions on the chemical soil test kit, each was tested for Phosphorus, Nitrogen, and Potash levels. Each soil sample was also tested for the presence of oil using oil test strips, in dry soil and in the water from the soil/water mixture. The researcher was instructed in the proper procedures for using the digital meters and for conducting the chemical tests of the soil. All of the testing was conducted in the middle school science lab under the supervision of the science teacher.

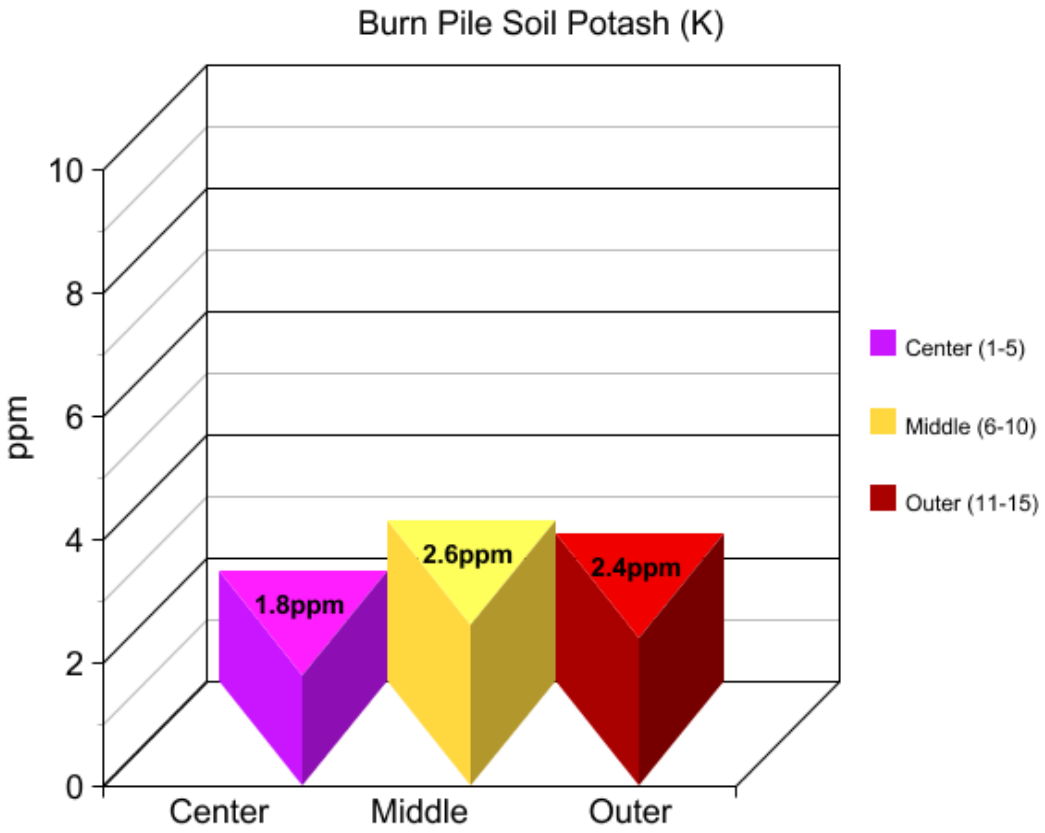
Digital Soil Moisture Meter	Digital Soil Fertility Meter
Chemical Soil Test Kit	Distilled Water
Plastic Beakers	Plastic Pipettes
Plastic Bags	Garden Spade
Oil Test Strips	Digital Timer

DATA SUMMARY

Burn Pile Soil Test Results									
	Nitrogen - N (ppm)			Phosphorous - P (ppm)			Potash - K (ppm)		
	Location of Sample			Location of Sample			Location of Sample		
Sample #	center	middle	outer	center	middle	outer	center	middle	outer
1	4	5	1	2	2	1	1	2	3
2	3	4	2	1	2	2	2	2	4
3	4	5	3	3	3	1	1	2	2
4	1	3	1	1	1	1	3	3	1
5	4	1	2	4	3	5	2	4	2
Total	16	18	9	11	11	10	9	13	12
Mean	3.20	3.60	1.80	2.20	2.20	2.00	1.80	2.60	2.40

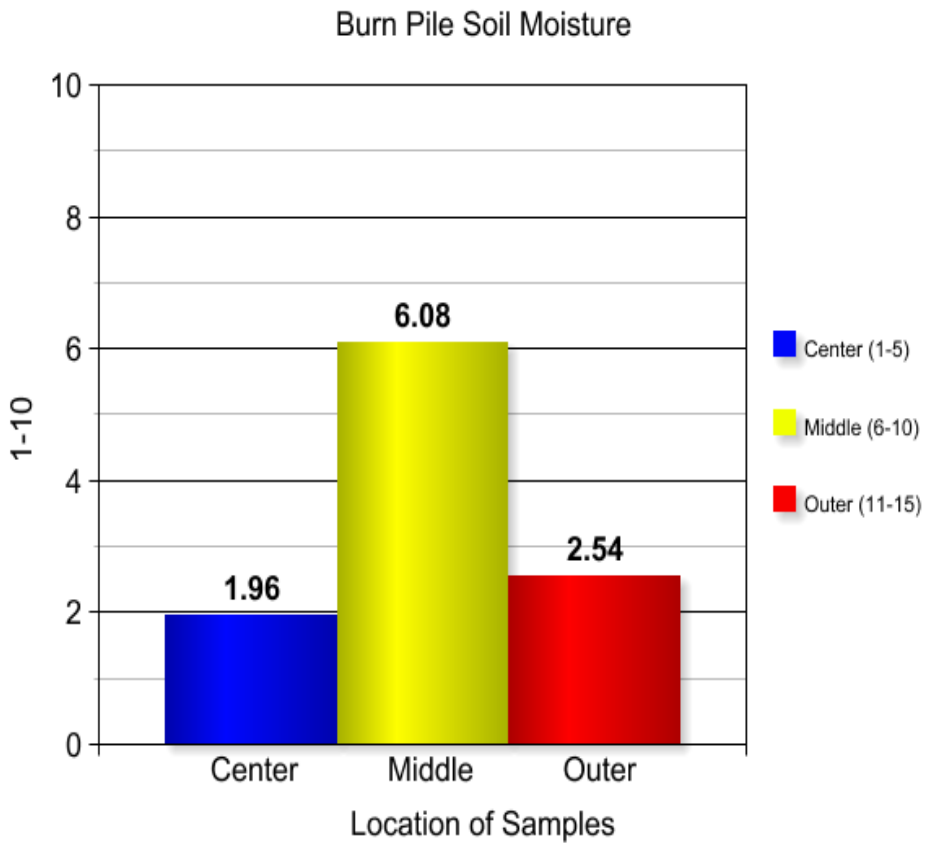


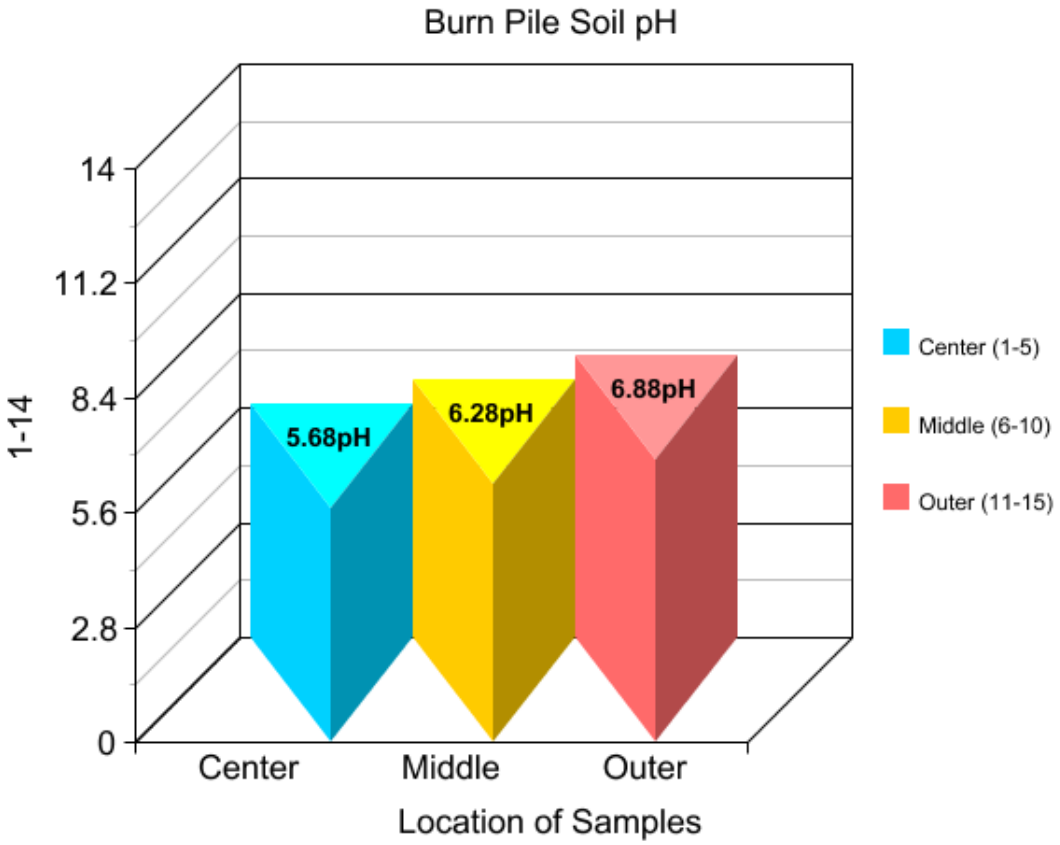

Burn Pile Soil Phosphates (P)
ppm
10
8
6
4
2
0
2.2ppm
2.2ppm
2ppm
Center
Middle
Outer
Center (1-5)
Middle (6-10)
Outer (11-15)


Burn Pile Soil Potash (K)
ppm
10
8
6
4
2
0
1.8ppm
2.6ppm
2.4ppm
Center
Middle
Outer
Center (1-5)
Middle (6-10)
Outer (11-15)

Burn Pile Soil Test Results

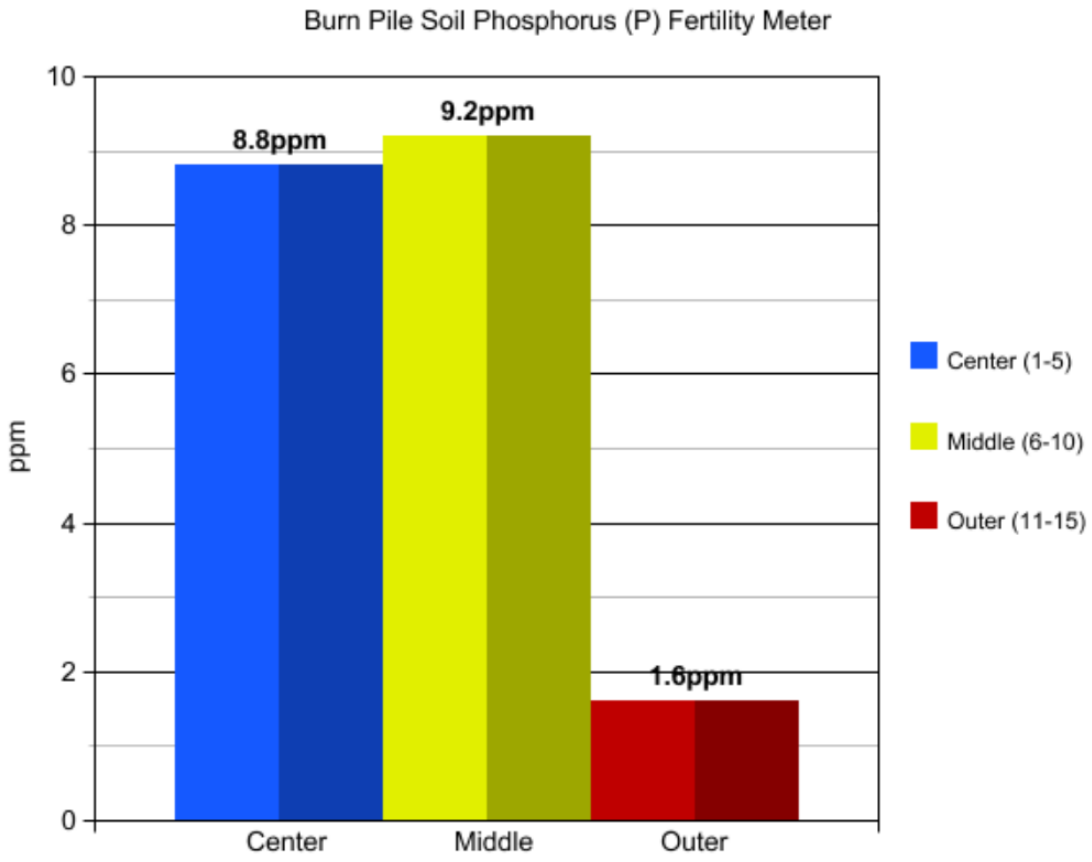
	pH (1-14)			Moisture (1-10)			Oil (ppm)		
	Location of Sample			Location of Sample			Location of Sample		
Sample #	center	middle	outer	center	middle	outer	center	middle	outer
1	5.9	6.5	7.0	1.6	7.9	2.0	0	0	0
2	5.5	6.3	7.0	2.5	8.8	2.3	0	0	0
3	4.8	4.9	6.4	1.5	7.1	3.3	0	0	0
4	6.4	6.7	7.0	1.6	3.0	2.8	0	0	0
5	5.8	7.0	7.0	2.6	3.6	2.3	0	0	0
Total	28.4	31.4	34.4	9.8	30.4	12.7	0	0	0
Mean	5.68	6.28	6.88	1.96	6.08	2.54	0	0	0

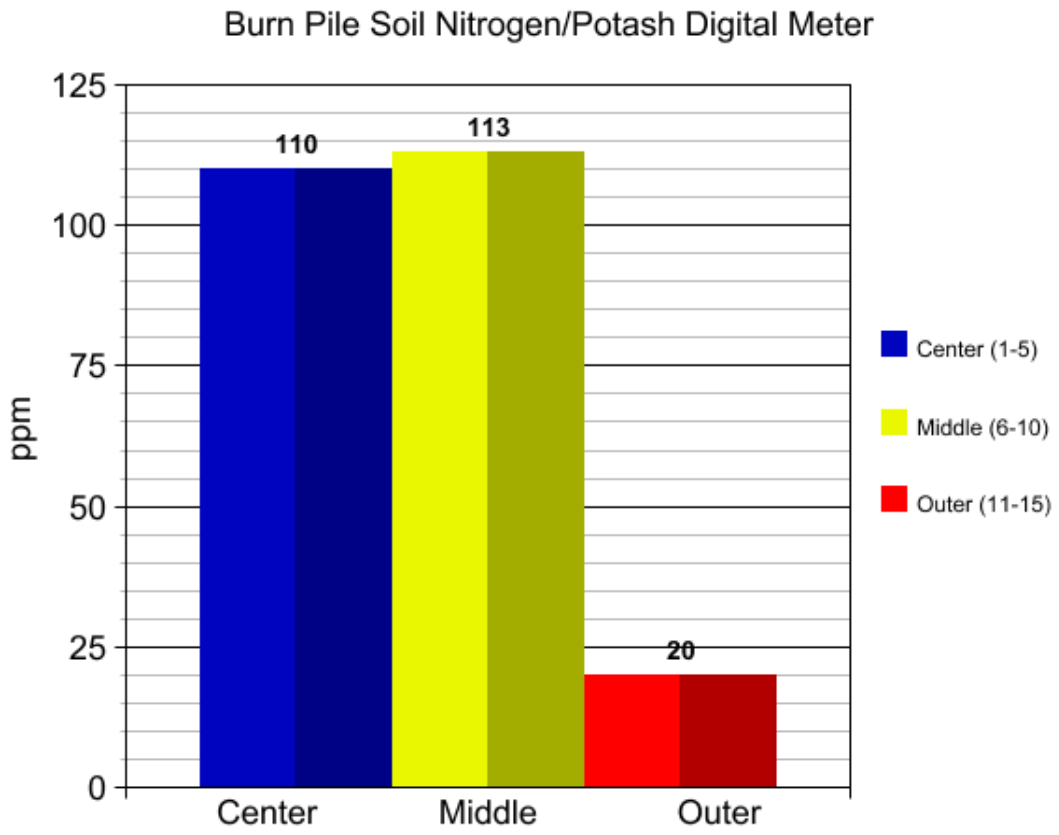

Burn Pile Soil Moisture
10
8
6
4
2
0
1-10
6.08
1.96
2.54
Center
Middle
Outer
Location of Samples
Center (1-5)
Middle (6-10)
Outer (11-15)

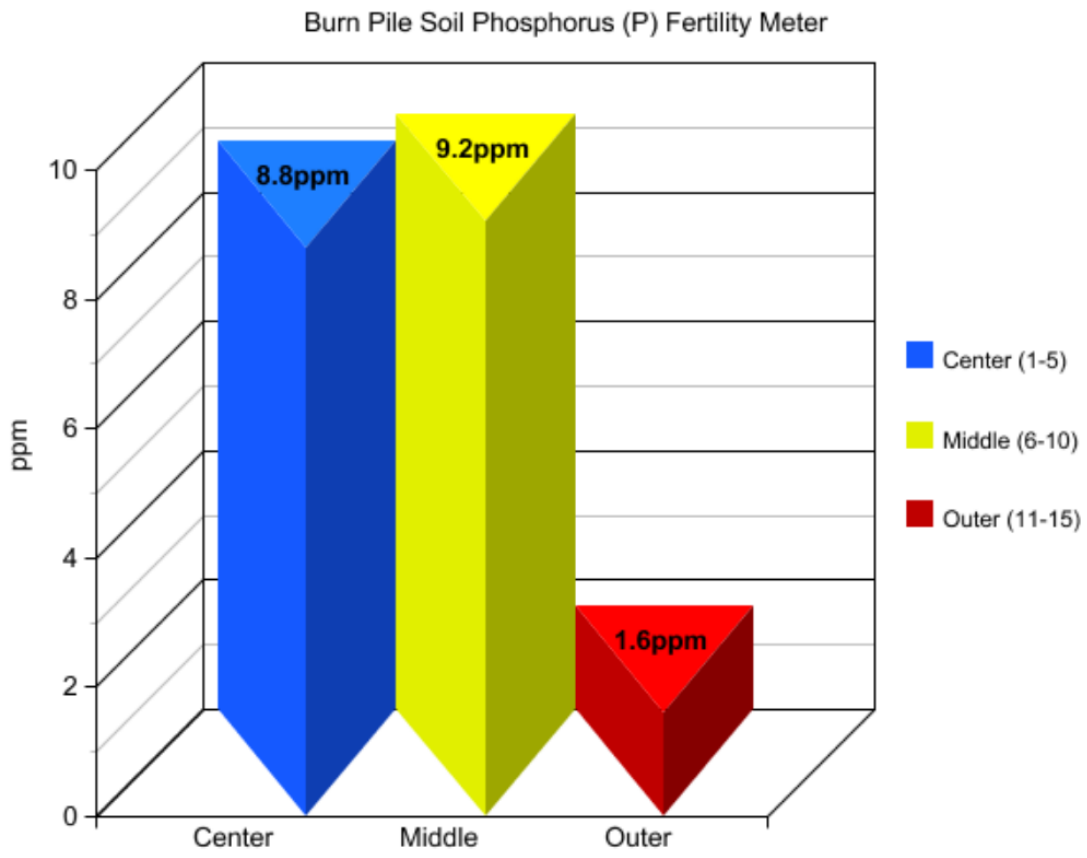

Burn Pile Soil pH
14
11.2
8.4
5.6
2.8
0
1-14
5.68pH
6.28pH
6.88pH
Center
Middle
Outer
Location of Samples
Center (1-5)
Middle (6-10)
Outer (11-15)

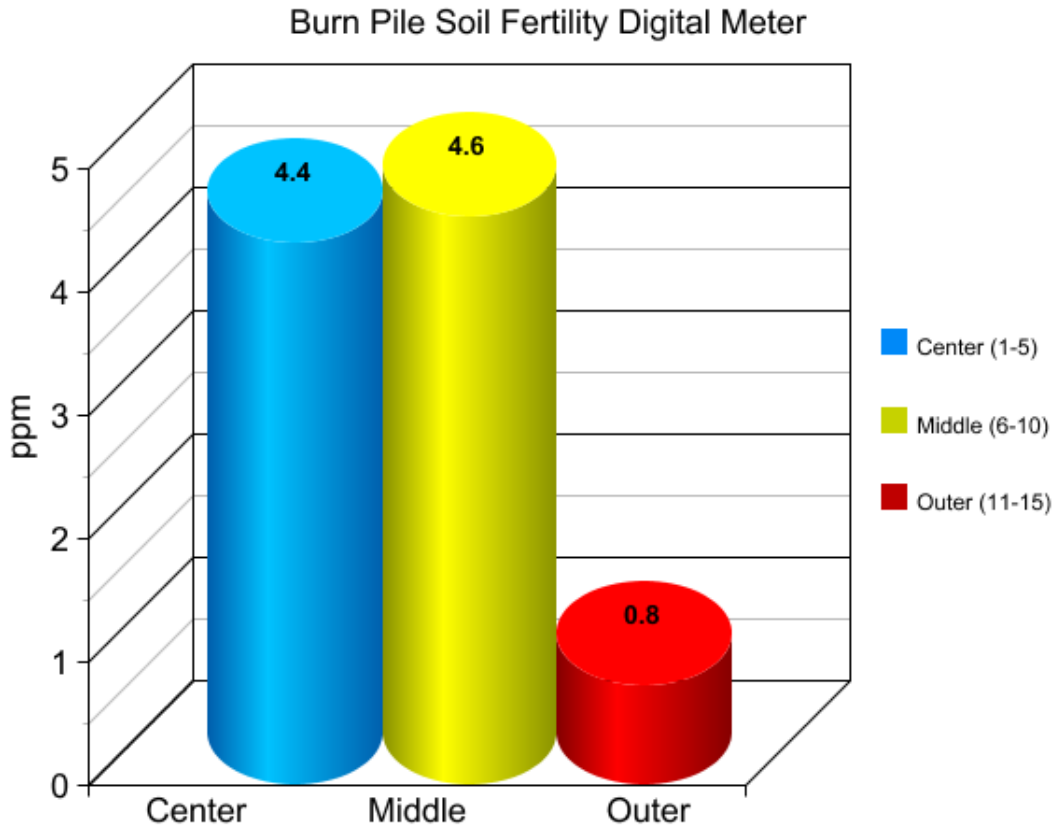
Burn Pile Soil Test Results Using a Digital Fertility Meter

	Fertility (0-10)			Nitrogen - N (ppm)			Phosphorous - P (ppm)			Potash - K (ppm)		
	Location of Sample			Location of Sample			Location of Sample			Location of Sample		
Sample #	center	middle	outer	center	middle	outer	center	middle	outer	center	middle	outer
1	4	3	0	100	75	0	8	6	0	100	75	0
2	5	8	0	125	205	0	10	16	0	125	205	0
3	5	9	3	125	210	75	10	18	6	125	210	75
4	5	2	0	125	50	0	10	4	0	125	50	0
5	3	1	1	75	25	25	6	2	2	75	25	25
Total	22	23	4	550	565	100	44	46	8	550	565	100
Mean	4.40	4.60	0.80	119.00	113.00	20.00	8.80	9.20	1.60	119.00	113.00	20.00


Burn Pile Soil Phosphorus (P) Fertility Meter
10
8
6
4
2
0
ppm
8.8ppm
9.2ppm
1.6ppm
Center
Middle
Outer
Center (1-5)
Middle (6-10)
Outer (11-15)


Burn Pile Soil Nitrogen/Potash Digital Meter
125
100
75
50
25
0
ppm
110
113
20
Center
Middle
Outer
Center (1-5)
Middle (6-10)
Outer (11-15)


Burn Pile Soil Phosphorus (P) Fertility Meter
ppm
10
8
6
4
2
0
8.8ppm
9.2ppm
1.6ppm
Center
Middle
Outer
Center (1-5)
Middle (6-10)
Outer (11-15)


Burn Pile Soil Fertility Digital Meter
ppm
5
4
3
2
1
0
4.4
4.6
0.8
Center
Middle
Outer
Center (1-5)
Middle (6-10)
Outer (11-15)

ANALYSIS AND RESULTS

Digital Soil Meter Test Results:

The average pH reading for the inner soil samples = 5.68, middle soil samples = 6.28, and the pH reading for the outer samples = 6.88. The average moisture reading for the inner soil samples = 1.96, middle soil samples = 6.08, and the moisture reading for the outer samples = 2.54. The average fertility reading for the inner soil samples = 4.4, middle soil samples = 4.6, and the fertility reading for the outer samples = 0.8. The fertility cross-referenced levels for Nitrogen for the inner soil samples = 119ppm, middle soil samples = 113ppm, and the Nitrogen reading for the outer samples = 20ppm. The fertility cross-referenced levels for Phosphorus for the inner soil samples = 8.8ppm, middle soil samples = 9.2ppm, and the Phosphorus reading for the outer samples = 1.6ppm. The fertility cross-referenced levels for Potash for the inner soil samples = 119ppm, middle soil samples = 113ppm, and the Potash reading for the outer samples = 20ppm.

Chemical Soil Test Results:

All of the samples tested negative for oil. The results for Nitrogen for the inner soil samples = 3.2ppm, middle soil samples = 3.6ppm, and the Nitrogen reading for the outer samples = 1.8ppm. The results for Phosphorus for the inner soil samples = 2.2ppm, middle soil samples = 2.2ppm, and the Phosphorus reading for the outer samples = 2.0ppm. The results for Potash for the inner soil samples = 1.8ppm, middle soil samples = 2.6ppm, and the Potash reading for the outer samples = 2.4ppm.

CONCLUSION

The data supported the hypothesis. The soil samples collected from the middle band of the burn pile had the most different levels compared to the inner and outer bands. The middle band had the highest moisture reading, and fertility reading from the digital meters. The chemical soil test results also indicated that the middle band had the highest readings for Nitrogen, Phosphorus, and Potash.

DISCUSSION

It appeared that the ashes from the burn pile helped increase the fertility level of the soil in the middle band of the burn pile. In the future the researcher would like to test for other chemical components of the soil around different burn piles and include testing farther out and downhill. It would also be good to test water run-off from the burn pile area to find out if contaminates are washed away.

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My teacher provided me with the testing materials.
My teacher also supervised my during testing and
Collecting the soil Sample for my testing .
My mom helped me with the wording to say to the judges.
She also gave me an idea on this project and so did my teacher.

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