A Life Change Project in a Cincinnati Suburban Home Comparing Alternatives to Clay Cat Litter

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Clay cat litter is just that - clay. All clay is mined from the earth, which has negative environmental impacts. Clay litter has to be harvested via a method called strip mining, which essentially uses heavy equipment to remove top layers of earth and soil to uncover calcium bentonite and sodium bentonite. Calcium bentonite is pressed and dried into small pellets which then can absorb moisture and odor, and is the basis of all traditional clay litter. Sodium bentonite is a specific type of clay, which when added to calcium bentonite creates the scooping effect of popular litters. Sodium bentonite is harvested annually in the United States to the amount of over five billion pounds, which is the largest market for bentonite, and makes the cat litter industry worth over $2 billion dollars (Gross, 2015).

Typical disposal for cat feces and urine is into a plastic bag and tossed into a landfill, and one source claims that over 160,000 tons of nonbiodegradable cat litter ends up in landfills in America each year (Yarnell, 2004). With more than one-third of American homes registering as cat owners (Ward, 1988), this also has environmental impacts as used clumping clay litter does not biodegrade (Hulett, 2016) and neither does the plastic bag (Gogte, 2009). More than 75% of the cat litters on the market use bentonite clay (Ward, 1988).

Additionally, bentonite is a crystalline silica, or aluminum phyllosilicate which is labeled as a carcinogen and each time a cat digs in the litterbox, silica dust is spread into the air of the house. Sodium bentonite can also cause gastrointestinal issues if ingested, which can happen while a cat grooms itself (Scheer & Moss, N.D.). There is research to show potential linkages between cancer and respiratory issues such as asthma in cats who use clay litter and those who do not, however the research is inconclusive (Corcoran, Foster, & Fuentes, 1995).

Luckily, there are several alternatives to clay cat litter on the market today including litters made from walnuts, wheat, paper, wood, grains, and even sand. Pine sawdust is collected from lumber waste and can be used as cat litter, as well as some paper recycling squeezed into pellets for use in litter boxes (Yarnell, 2004). Flushable cat litters can also be collected and spread out as manure, as long as the cats are parasite and disease free (Yarnell, 2004). All of these options offer alternatives to the traditional clay cat litter and can have benefits on the environment as well as the cat. Even though these alternative litters are more expensive than

clay litter, they are only priced about 30% more per pound for the most expensive ecofriendly litter when compared to clay litter (Laron, 2017).

An alternative to a litter box for indoor cats is toilet training. This process is recommended for confident cats older than 3 months and not recommended for older, arthritic cats or cats who for any reason cannot jump up to the toilet (Moore, 2004). By using a tray of flushable litter over the course of several weeks over the top of the toilet water, the cat learns to eliminate in the tray. After the cat is confident, the tray is switched out to another tray with a small opening in the center. As the cat progresses in confidence, the tray can be switched out to smaller and smaller trays with larger openings to the water beneath. Finally, when ready, the tray and litter can be removed altogether and the cat can eliminate directly into the toilet by sitting on the toilet seat.

This paper uses a four cat household to research cat litter preference and alternatives to clay clumping litter, as well as alternatives to the disposition of cat feces and urine. Researching alternatives to strip mined clay litter and creating action has a positive effect on the environment as well as a reduction in potential silica dust related health issues for felines and humans in the house. Reduction or refinement of cat waste disposal is an all-around win for local communities as well as the environment as a whole.

Methods

Five large Rubbermade bins were weighed while empty using a Trailite TL-LSC01 Digital Travel Scale, and then numbered 1 through 5. These bins were filled with three to four inches of Tidy Cats scoopable clay litter, as per the manufacturer's instructions, and the typical routine for this household. All five bins were weighed and placed back in their typical location in the basement for 48 hours. After 48 hours, the bins were weighed again and then solid waste was removed from the bins. The solid waste was placed into a plastic shopping bag, weighed again, and disposed of in the city trash to go to the landfill. This process was repeated over the course of two weeks, for six data points serving as baseline (Appendix A, Table 1 and Appendix B, Table 2).

After the baseline period of two weeks was completed, Bins One and Two continued to house Tidy Cats scoopable clay litter, Bin Three was transitioned to Blue Buffalo Walnut-Based Cat Litter, Bin Four was transitioned to sWheat Scoop fast-clumping wheat litter, and Bin Five was transitioned to Yesterday’s News, litter pellets made from recycled newspapers. Waste

material collected from Bins Three through Five were weighed and then placed outside in a compost pile, which will not be used for growing food. In addition to the five litter boxes in the basement, a spare bathroom on the main floor of the house was used in an attempt to toilet train the cats in the household using a cat toilet training system and flushable, sWheat Scoop wheat litter.

A cat toilet training system was installed in a spare bathroom on the main floor of the house. An aluminum roaster pan 16 inches by 13 ⅛ inches and 3 ⅛ inches tall was purchased at the local grocery store. This pan fit nicely under the seat of the toilet without much manipulation (Figure 1). The pan was filled with one inch of sWheat Scoop fast-clumping wheat litter for three weeks and the toilet lid was kept open. Verbal encouragement was given to cats exploring the toilet and food rewards were given when a cat used the toilet litter box for defecating or urinating when this behavior was observed. Up to three times over 48 hours, the pan was scooped and solid waste removed and placed into a small bag, and weighed (Appendix C, Table 3). Then the pan of litter was briefly removed from the toilet, the bag of waste was dumped into the toilet and flushed, and the litter pan replaced. If there was no waste in the pan, the pan was not scooped, therefore waste was not weighed nor flushed.

Figure 1. Pan in place under toilet seat lid.

Every 48 hours, the basement bins were weighed, and then scooped and waste material from each type of litter was weighed. This process was repeated over the course of three weeks, for 10 data points for this study (Appendix D, Table 4 and Appendix E, Table 5).

Before any waste was spread outside in compost, all cats were tested for internal parasites via a fecal examination and infectious disease via blood work (feline leukemia and feline immunodeficiency virus) at their regular veterinarian. Internal parasites were checked by examining a sample of fecal material under the microscope looking for parasites or parasite eggs (Kazacos, Paul, 2006). Blood work was performed using an ELISA test to verify the lack of antibodies for these diseases (Chhetir, Berke, Pearl, & Bienzle, 2013).

The experiment was conducted over the course of three weeks, gathering information around total waste contributed to landfills or compost between each product and water used in toilet training cats. Data was also collected around soiling outside of litter boxes and any change in cat behavior.

For ease of understanding, the weight of waste in this report will be translated into the weight of one average adult cat. The average adult cat weighs 8.9 pounds (Reeve-Johnson, Rand, Anderson, Appleton, Morton, & Vankan, 2016), so throughout the results section, the weight of waste will be described as the weight in cats. The weight of waste will be divided by 8.9 pounds, the weight of an average cat. A t-test was conducted to compare the different litter types to clay litter in terms of cat preference as well as an ANOVA test to evaluate preference in litter bins.

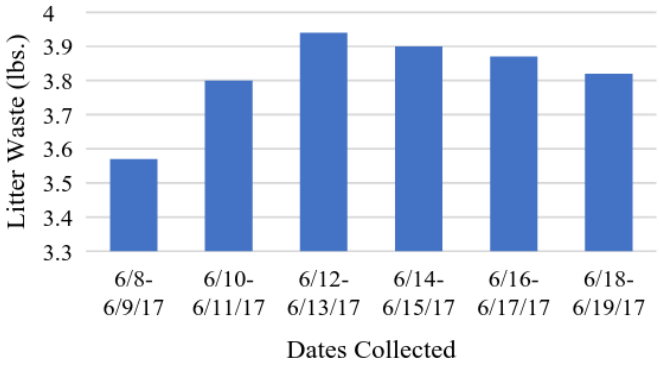
Figure 2. Kitten using toilet training system.

Results

There were four cats in this study, two males and two females. Both males and one female were adult sterilized cats, and one female was a 3 month old kitten. Overall, the three adult cats were the most hesitant to use the toilet training system. The kitten was the only cat to successfully utilize the toilet litter box throughout the duration of the study (Figure 2).

During the initial baseline data collection from June 8 to June 19, 2017, the five litter bins were scooped 6 times, every 48 hours. This was the typical scooping routine for this household. Over 14 days, 22.9 pounds of cat waste and clay litter was scooped, placed into plastic bags (6), and tossed into the curb side garbage collection of Cincinnati to go to a landfill. This equates to the weight of 2.76 cats disposed of. During the baseline portion of this study, 3.57 to 3.94 pounds of waste were collected and thrown away every 48 hours (Figure 3).

OFigure 3. Baseline Data: Weight of Cat Waste and Clay Litter Disposed in Landfill Over 2 Weeks in a 4 Cat Household



There was no temporal trend observed during the baseline data collection. There was a significant difference between bins, with bin 3 most favored and bin 4 the least ($p<0.001$ via ANOVA). For statistical evaluation of the study data measurements, preference in bins were adjusted for when comparing litter types to avoid litter bin preference bias.

After the baseline measurements were complete, two of the five litter bins were kept consistent. During the three-week phase of the study, anywhere from 1.39 to 2.30 pounds of clay litter and waste were scooped and thrown into the landfill in 48 hours. For the walnut litter, 0.67 to 0.96 pounds, for the wheat litter, 0.55 to 0.76, and for the newspaper litter, 0.3 to 0.70 pounds of litter were scooped and disposed of in the compost pile (Figure 4). A total of 19.37 pounds of ecofriendly cat litter and waste were composted over the course of this study (Figure 4). A total of 17.59 pounds of clay cat litter and waste were contributed to a landfill (Figure 5). This means that almost three times the weight of an average sized cat was composed, while almost two times the weight of an average sized cat contributed to landfill waste.

Figure 4. Study Data: Weight of Cat Waste and Litter Composted over 3 Weeks in a 4 Cat Household

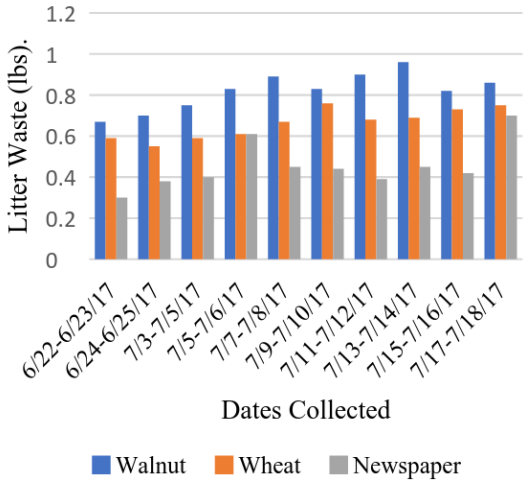
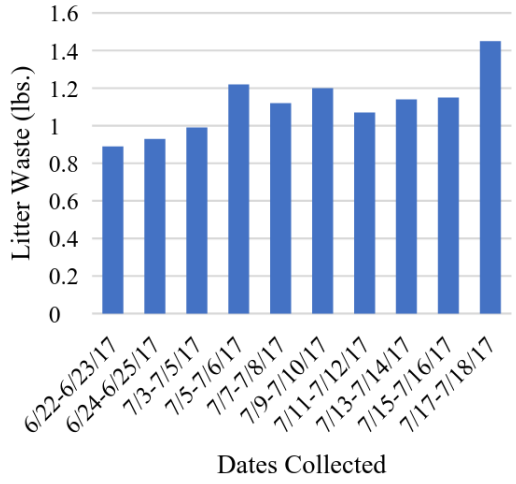
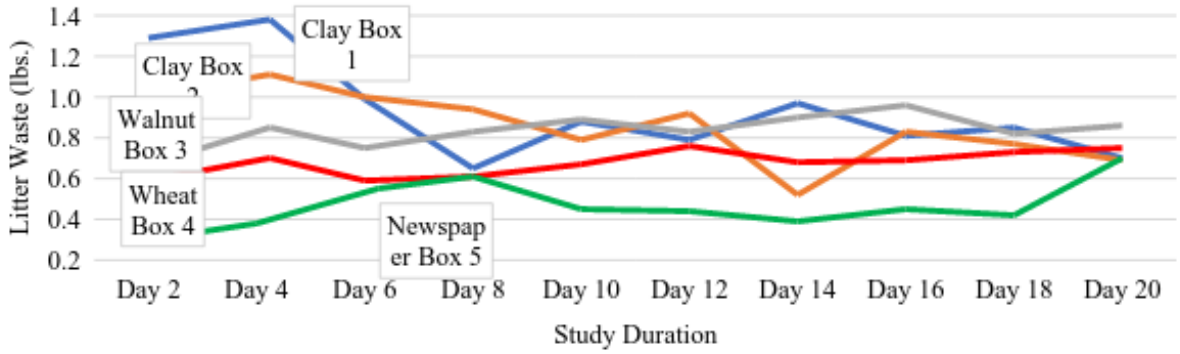


Figure 5. Study Data: Weight of Cat Waste and Litter Disposed of in Landfill over 3 Weeks in a 4 Cat Household



For the cat waste which was scooped from the wheat litter and flushed, only 0.51 pounds were saved from the landfill during the three-week study. This only equates to 6% the body weight of a cat. In this study, 33.6 gallons of water were used to flush the cat waste, 1.6 gallons per flush, which is enough water to survive a cat for 1,433 days (a cat requires an average of 3 ounces of water a day, (Brehm, 2011)).

Figure 6. Litter Type Preferences by Litter Bin



The overall results from the three-week study period in Figure 6 (see Appendix F for statistical calculations) show that clay litter started out as the preferred litter by all four cats, however usage declined over the first eight to ten days. Clay litter was slightly preferred to walnut litter ($p=0.055$, t-test) and significantly preferred to newspaper litter ($p=0.003$, t-test). The wheat based litter was significantly preferred to clay litter ($p=0.012$, t-test).

Discussion

Data was not collected between June 26, 2017 to July 4,2017 due to vacation schedules. On July 11th, 2017, the female kitten was spayed which reduced her ability to use the toilet litter box until July 12th, 2017, which is apparent in the data. The most notable result is the preference in wheat litter over clay litter when bin preference is removed from the data. Toilet training the kitten did not save much waste from going to a landfill (only 0.51 pounds) but utilized 33.6 gallons of water. As far as sustainable cat waste removal practices are concerned, the use of water to flush the waste was a greater environmental impact than the small contribution of waste to the landfill of 0.51 pounds (Lenius, 2014).

It was assumed that the clay litter would be the preferred litter choice of all cats. However, the data showed that each litter substrate was utilized, with wheat litter being preferred over clay litter. Even though wheat litter is more expensive than clay litter, it is estimated that over the course of one year, only $75 additional dollars would be spent to use wheat litter and compost the waste for this household. This transition would save the household in this study approximately 600 pounds of clay litter and cat waste from being disposed of in a landfill!

To prevent any potential inappropriate elimination by any of the cats on study, two bins were kept constant with clay litter. The cats in this household have only used clay litter for their entire lives, and there was no reason to drastically change their litter box substrate material for

this study. Removing all the clay litter during the three-week study data collection timeframe could have led to an increase in inappropriate elimination, changes in cat behavior, and a bias in the study data.

During this study, there was only one incident of inappropriate elimination outside of the litter bins. However, the behavior of occasionally urinating in empty laundry baskets was observed for several months before the start of this study. The inappropriate elimination does not seem to be linked to this study. There were no noticeable behavior changes in the cats over the course of this study.

By using compostable cat litter, there are many benefits. Composting waste material assists in building top soil, can be used to cultivate plant growth, saves fuel and resources that would go into transporting garbage to the landfill, and can conserve water (Moretti, 2015). Composting fecal material adds bacterial diversity to the soil, which can strengthen plants and their root systems (Klimas, Szymariska-Pulikowska, Gorka, & Wienczorek, 2016). Having strong root systems helps the plant maintain moisture within the plant itself, and therefore decreases water runoff (Klimas, Szymariska-Pulikowska, Gorka, & Wienczorek, 2016).

Community Engagement

Using this research, I am trying to arrange a lecture where I work to discuss the alternatives to clay cat litter and why clay litter is rough on the environment. Part of my Master Plan is going to be creating and spreading a website around to local shelters and veterinary offices, and I will use the research from this life change project as an addition to my webpage, encouraging the use of alternative litters. By tapping into my coworkers, I have access to 15 veterinary technicians who own cats and can help me spread the word once they learn through me the importance of not using clay litter as a sole litter source.

Conclusion

One of the most surprising finds from this study was that toilet training cats does not help the environment. I was disappointed that the kitten was the only feline to utilize the toilet, and discouraged it is not a sustainable method for disposing of cat waste. Overall, the cats in my household will be transitioned to using wheat litter. I am very fortunate that they took to the wheat litter as well as they did. I want to see if my compost pile is able to hold several hundred pounds of cat feces and how the process continues even though the study is over, and through the winter. There is no way I can go back to using solely clay litter after knowing the environmental

impacts it causes to strip mine and dispose of. I am thankful for the opportunity to explore alternatives to clay litter and am so glad to have found a sustainable way to keep indoor cats.

Literature Cited

Brehm, D. The physics of how cats drink. *Technology Review, 114(2),* 6.

Chhetri, B.K., Berke, O., Pearl, D.L., & Bienzle, D. (2013). Comparison of the geographical distribution of feline immunodeficiency virus and feline leukemia virus infections in the United States of America (2000 – 2011). *BMC Veterinary Research, 9,* 2 – 6.

Corcoran, B.M., Foster, D.J., & Fuentes, V.L. (1995). Feline asthma syndrome: A retrospective study of the clinical representation in 29 cats. *Journal of Small Animal Practice, 36(11),* 481 - 488.

Gogte, M. (2004). Are plastic grocery bags sacking the environment? *International Journal for Quality Research, 3(4).*

Gross, D.A. (2015). How kitty litter went from happy accident to $2 billion industry. *Health & Science.* Retrieved from: https://www.washingtonpost.com/national/health-science /you-wont-believe-how-old-that-kitty-litter-is/2015/02/02/9ecac9ea-a1b4-11e4-903f 9f2faf7cd9fe_ story.html?utm_term=.c16798faaa55

Hulett, J. (2016). Here's the scoop on buying cat litter. *The Christian Science Monitor.*

Kazacos, K.R., & Paul, M. (2006). Questions feline parasite survey methods. *Journal of the American Veterinary Medical Association, 228(12),* 1858 – 1859.

Klimas, E., Szymariska-Pulikowska, A., Gorka, B., & Wienczorek, P. (2016). Presence of plant hormones in composts made from organic fraction of municipal solid waste. *Journal of Elementology, 21(4),* 1043 – 1053.

Laron, C. (2017). Cat litter reviews. *Consumer Research.* Retrieved from:. consumersearch.com/cat-litter.

Lenius, P. (2014). Show us the GREEN… *Reeves Journal: Plumbing, Heating, Cooling, 94(3),* 24 – 26.

Moore, A. (2004). Toilet train your cat? *Prevention, 56(2).*

Moretti, S. (2015). Composting sewage sludge with green waste from tree pruning. *Scientia Agricola, 72(5).*

Murray, H. (2002). Industrial clays case study. *Mining, Minerals, and Sustainable Development, 64,* 1 - 9.

Reeve-Johnson, M.K., Rand, J.S., Anderson, S.T., Appleton, D.J., Morton, J.M., & Vankan, D. Dosing obese cats based on body weight spuriously affects some measures of glucose

tolerance. *Domestic Animal Endocrinology, 57,* 133 – 142.

Scheer, R., & Moss, D. (N.D). What are the most ecofriendly cat litter products on the market? *Scientific American, Sustainability.* Retrieved from: https://www.scientificamerican.com/article/green-friendly-cat-litter-options/

Ward, P. (1988). Filler's the name, odor's the game. *Fortune.*

Yarnell, A. (2004). Kitty litter. Clay, silica, and plant-derived alternatives compete to keep your cat's box clean. *Science & Technology, 82(17),* 26.

Appendix A - Baseline Data: Bins with Waste

Table 1

Waste + litter (lbs)/48 hour	1	2	3	4	5	Total
6/6-6/7/17	17.38	19.88	20.03	17.89	18.79	93.97
6/8-6/9/17	16.77	19.08	19.19	17.20	18.16	90.4
6/10-6/11/17	16.13	18.25	18.16	16.53	17.53	86.6
6/12-6/13/17	15.52	17.37	17.06	15.92	16.79	82.66
6/14-6/15/17	14.78	16.58	16.03	15.31	16.06	78.76
6/16-6/17/17	14.07	15.77	15.04	14.73	15.28	74.89
6/18-6/19/17	13.42	14.9	14.15	14.06	14.54	71.07
Average	17.38	19.88	20.03	17.89	18.79	

Appendix B – Baseline Data: Scooped Waste

Table 2

Waste (lbs)/48 hour	1	2	3	4	5	Total
6/6-6/7/17	NA	NA	NA	NA	NA	NA
6/8-6/9/17	0.61	0.8	0.84	0.69	0.63	3.57
6/10-6/11/17	0.64	0.83	1.03	0.67	0.63	3.8
6/12-6/13/17	0.61	0.88	1.1	0.61	0.74	3.94
6/14-6/15/17	0.74	0.79	1.03	0.61	0.73	3.9
6/16-6/17/17	0.71	0.81	0.99	0.58	0.78	3.87
6/18-6/19/17	0.65	0.87	0.89	0.67	0.74	3.82
Average	0.66	0.83	0.98	0.64	0.71	

Appendix C - Study Data: Toilet Litter Box

Table 3

Waste (g)/session	1	2	3	Total
6/20-6/21/17	15	13	0	28
6/22-6/23/17	17	10	9	36
6/24-6/25/17	8	10	0	18
7/5-7/6	0	0	9	9
7/7-7/8	14	12	6	32
7/9-7/10	9	7	13	29
7/11-7/12	0	0	0	0
7/13-7/14	5	11	0	16
7/15-7/16	0	13	10	23
7/17-7/18	10	0	0	10
7/19-7/20	15	17	0	32
Average	7.80	8.00	4.70	233

Appendix D – Study Data: Basement Litter Bins with Waste

Table 4

Waste (lbs)/48 hour	1	2	3	4	5	Total
6/20-6/21/17	18.37	17.59	15.44	12.31	13.78	77.49
6/22-6/23/17	17.08	16.58	14.77	11.72	13.48	73.63
6/24-6/25/17	15.85	15.62	14.07	11.17	13.1	69.81
7/5-7/6	14.86	14.62	13.32	10.58	12.7	66.08
7/7-7/8	14.21	13.68	12.49	9.97	12.09	62.44
7/9-7/10	13.33	12.89	11.6	9.3	11.64	58.76
7/11-7/12	12.54	11.97	10.77	8.54	11.2	55.02
7/13-7/14	11.57	11.45	9.87	7.86	10.81	51.56
7/15-7/16	10.76	10.62	8.91	7.17	10.36	47.82
7/17-7/18	9.91	9.85	8.09	6.44	9.94	44.23
7/19-7/20	9.21	9.16	7.23	5.69	9.24	40.53
Average	12.93	12.64	11.11	8.84	11.46	

Appendix E – Study Data: Basement Litter Bins, Scooped Waste

Table 5

Waste (lbs)/48 hour	1	2	3	4	5	Total
6/20-6/21/17	NA	NA	NA	NA	NA	NA
6/22-6/23/17	1.29	1.01	0.67	0.59	0.3	3.86
6/24-6/25/17	1.23	0.96	0.7	0.55	0.38	3.82
7/5-7/6	0.99	1	0.75	0.59	0.4	3.73
7/7-7/8	0.65	0.94	0.83	0.61	0.61	3.64
7/9-7/10	0.88	0.79	0.89	0.67	0.45	3.68
7/11-7/12	0.79	0.92	0.83	0.76	0.44	3.74
7/13-7/14	0.97	0.52	0.9	0.68	0.39	3.46
7/15-7/16	0.81	0.83	0.96	0.69	0.45	3.74
7/17-7/18	0.85	0.77	0.82	0.73	0.42	3.59
7/19-7/20	0.7	0.69	0.86	0.75	0.7	3.7
Average	0.92	0.84	0.82	0.66	0.45	

Appendix F – Statistical Calculations

Two-Sample T-Test and CI: Box 1, Clay Box 1

Two-sample T for Box 1 vs Clay Box 1

	N	Mean	StDev	SE Mean
Box 1	6	0.6600	0.0537	0.022
Clay Box 1	6	0.8333	0.0909	0.037

Difference = μ (Box 1) - μ (Clay Box 1)

Estimate for difference: -0.1733

95% CI for difference: (-0.2727, -0.0739)

T-Test of difference = 0 (vs ≠): T-Value = -4.02 P-Value = 0.004 DF = 8

Two-Sample T-Test and CI: Box 2, Clay Box 2

Two-sample T for Box 2 vs Clay Box 2

	N	Mean	StDev	SE Mean
Box 2	6	0.8300	0.0374	0.015
Clay Box 2	6	0.753	0.137	0.056

Difference = μ (Box 2) - μ (Clay Box 2)

Estimate for difference: 0.0767

95% CI for difference: (-0.0723, 0.2256)

T-Test of difference = 0 (vs ≠): T-Value = 1.32 P-Value = 0.243 DF = 5

Two-Sample T-Test and CI: Box 3, Walnut Box 3

Two-sample T for Box 3 vs Walnut Box 3

	N	Mean	StDev	SE Mean
Box 3	6	0.9800	0.0972	0.040
Walnut Box 3	6	0.8767	0.0516	0.021

Difference = μ (Box 3) - μ (Walnut Box 3)

Estimate for difference: 0.1033

95% CI for difference: (-0.0029, 0.2096)

T-Test of difference = 0 (vs ≠): T-Value = 2.30 P-Value = 0.055 DF = 7

Two-Sample T-Test and CI: Box 4, Wheat Box 4

Two-sample T for Box 4 vs Wheat Box 4

	N	Mean	StDev	SE Mean
Box 4	6	0.6383	0.0440	0.018
Wheat Box 4	6	0.7133	0.0383	0.016

Difference = μ (Box 4) - μ (Wheat Box 4)
Estimate for difference: -0.0750
95% CI for difference: (-0.1289, -0.0211)
T-Test of difference = 0 (vs ≠): T-Value = -3.15 P-Value = 0.012 DF = 9

Two-Sample T-Test and CI: Box 5, Newspaper Box 5

Two-sample T for Box 5 vs Newspaper Box 5

	N	Mean	StDev	SE Mean
Box 5	6	0.7083	0.0631	0.026
Newspaper Box 5	6	0.475	0.113	0.046

Difference = μ (Box 5) - μ (Newspaper Box 5)
Estimate for difference: 0.2333
95% CI for difference: (0.1088, 0.3579)
T-Test of difference = 0 (vs ≠): T-Value = 4.43 P-Value = 0.003 DF = 7