

3.9 Decay Rate of Humanure

The decay rate indicates the excreta decay over passage of time. The optimum NPK values of the compost were incubated and were monitored at two different temperatures for 22 consecutive days. The Initial Weight (Table-1), Volume (Table-2), Densities (Table-3), Initial NPK values are shown in Table- 4. Then the decay rate of the mixtures was monitored.

Table 1:Weights of the additives and composts

Material	Initial Wt (gm)	Final weight (gms)		
		At 55 °C	Room temp	Under sunlight
Humanure (H)	10	4.66	5.57	6.38
Saw Dust (SD)	10	8.32	8.91	9.02
Rise Husk (RH)	10	8.33	8.64	9.53
Wood Ash (WA)	10	8.92	9.35	9.47
H + SD	10	6.97	7.56	8.95
H + RH	10	7.26	7.80	8.64
H + WA	10	6.20	6.55	7.89

Table 2:Volume of the additives and composts

Material	Initial Volume /cc For 10 g	Final weight (gms)		
		At 55 °C	Room temp	Under
Humanure (H)	12.00	06.0	06.8	07.2
Saw Dust (SD)	28.00	14.0	16.0	17.4
Rise Husk (RH)	23.20	11.2	14.0	15.9
Wood Ash (WA)	25.00	17.8	18.4	19.1
H + SD	21.60	16.0	17.1	17.7
H + RH	19.20	15.2	15.8	16.3
H + WA	22.50	16.9	17.6	18.1

Table 3:Density of the additives and composts

Material	Initial volume /cc For 10 g	Final weight (gms)		
		At 55 °C	RoomTemp	Under sunlight
Humanure (H)	12.00	06.0	06.8	07.2
Saw Dust (SD)	28.00	14.0	16.0	17.4
Rise Husk (RH)	23.20	11.2	14.0	15.9
Wood Ash (WA)	25.00	17.8	18.4	19.1
H + SD	21.60	16.0	17.1	17.7
H + RH	19.20	15.2	15.8	16.3
H + WA	22.50	16.9	17.6	18.1

Table 4:Initial NPK Values Additives

Material	N	P	K
H	05.77	07.59	00.50
SD	15.40	53.27	04.10
RH	13.51	03.39	01.60
WA	00.89	01.50	04.50

The experiments for the estimation of NPK values from the compost along with different additives were carried out for consecutive 22 days and showed in the following tables.

Table 5: Nitrates, phosphates, potassium values of Humanure + Saw Dust

Days	Humanure + Saw Dust					
	Nitrates		Phosphates		Potassium	
	55 °C	RM	55 °C	RM	55 °C	RM
1	69.63	66.54	21.62	19.67	5.0	4.5
3	80.02	68.21	11.93	13.67	4.5	1.5
5	86.17	69.97	14.24	20.89	4.0	2.3
6	86.26	72.53	14.57	21.09	2.2	1.8
7	94.54	76.72	15.10	27.46	3.6	3.8
8	97.65	83.03	15.73	27.65	3.8	4.0
9	106.2	84.56	16.85	28.41	3.5	3.7
10	111.2	85.89	17.24	29.88	3.9	3.8
12	113.4	71.64	17.98	31.62	4.1	4.0
13	121.7	77.11	18.26	33.70	4.4	4.3
14	125.9	86.90	19.03	34.05	4.9	4.5
15	130.3	93.38	19.42	36.94	5.0	4.8
16	138.1	95.42	19.99	37.09	5.1	5.0
17	140.6	98.74	20.56	38.56	5.3	5.0
19	141.2	102.01	21.13	39.73	5.5	5.1
20	142	103.31	22.25	40.15	5.6	5.2
21	143.9	104.07	22.97	40.72	5.7	5.3
22	145.5	105.66	23.61	41.47	5.7	5.4

Table 6: Nitrates, phosphates, potassium values of Humanure+ Rise Husk

Day	Humanure + Risk Husk					
	Nitrates		Phosphates		Potassium	
	55 °C	RM	55 °C	RM	55 °C	RM
1	27.77	25.43	08.89	09.65	1.6	1.9
3	11.22	12.24	14.17	10.99	0.1	2.3
5	07.46	19.55	27.84	19.99	0.9	1.7
6	10.48	07.55	35.07	32.68	1.5	4.8
7	16.72	08.03	31.70	46.49	1.9	4.2
8	15.54	08.50	39.44	45.67	1.8	4.3
9	16.08	08.98	45.96	46.89	1.6	4.6
10	16.98	09.47	52.99	47.96	1.7	4.7
12	17.79	10.79	55.63	49.11	1.9	4.9
13	19.13	11.84	58.78	50.74	2.0	5.0
14	21.56	14.37	59.46	51.60	2.1	5.1
15	22.14	15.54	63.52	58.51	2.5	5.4
16	22.45	16.46	65.71	64.96	2.7	5.5
17	23.79	17.85	66.64	67.28	2.8	5.6
19	24.73	19.84	67.04	71.23	2.9	5.8
20	25.65	21.67	68.29	74.20	3.0	5.8
21	26.61	25.76	69.13	75.82	3.1	5.9
22	27.33	29.27	70.80	76.45	3.2	5.9

Table 7: Nitrates, phosphates, potassium values of Humanure + Wood Ash

Day	Humanure + Wood Ash					
	Nitrate		Phosphat		Potassium	
	55 °C	RM	55 °C	RM	55 °C	RM
1	09.92	08.87	12.07	10.14	2.9	3.2
3	10.41	09.95	12.20	10.75	2.8	3.3
5	11.96	10.23	12.43	11.29	2.9	3.5
6	12.10	11.66	13.74	12.73	3.1	3.4
7	12.98	13.04	14.12	13.27	3.1	3.3
8	13.87	13.89	14.96	14.07	3.4	3.5
9	14.55	15.11	15.04	15.27	3.8	3.6
10	15.85	17.79	15.67	16.08	4.5	3.8
12	16.63	18.60	16.45	16.96	4.7	3.9
13	17.29	19.34	17.18	17.48	4.8	4.6
14	18.68	20.47	18.04	18.16	4.9	5.5
15	20.06	22.85	19.16	18.87	5.0	6.7
16	21.82	23.26	20.20	19.71	5.1	7.1
17	23.58	26.73	21.00	20.63	5.3	7.4
19	25.64	29.91	21.90	21.09	5.4	7.8
20	25.99	30.20	22.61	22.75	5.6	8.5
21	27.58	31.55	23.36	23.80	5.9	8.9
22	31.01	32.76	25.76	24.19	6.0	9.5

3.9.1 Degradation of Nitrate

The nitrate values are high at both the experimental temperature and at room temperature in the mixture which has saw dust as an additive. The other two mixtures however show the similar values at 55⁰c but the nitrate values are high in the mixture of wood ash in room temperature than the one with rice husk as an additive as shown in the figure 3.17 and 3.18

3.9.2 Degradation of Phosphate

From the figure 3.19 and 3.20 we can observe that phosphate values are high in rice husk at both the temperature. The other two mixtures have similar values at 55⁰c but saw dust shows higher values than wood ash at room temperature.

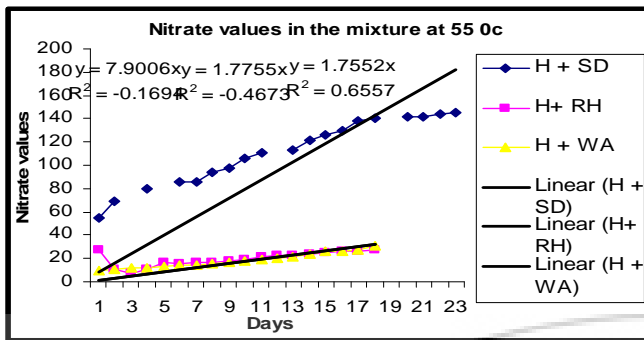


Figure 3.17: Nitrate values in the mixtures at 55^o c

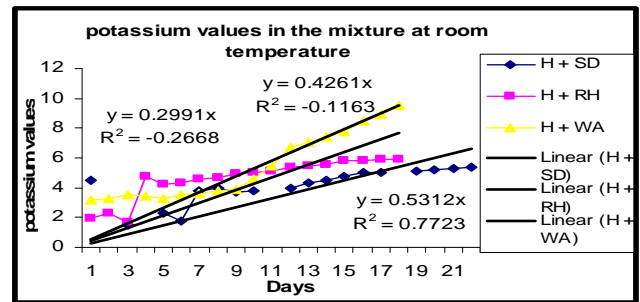


Figure 3.22 Potassium values in the mixtures at room temperature

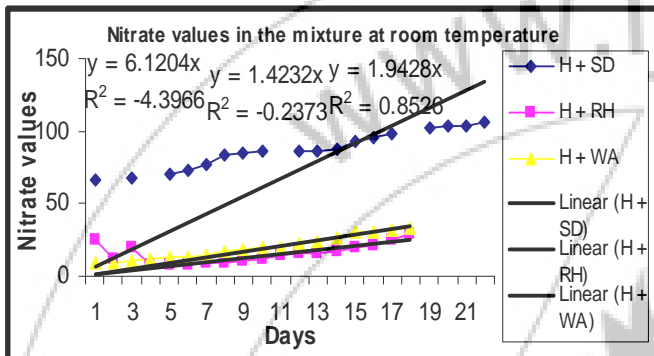


Figure 3.18: Nitrate values in the mixtures at room temperature

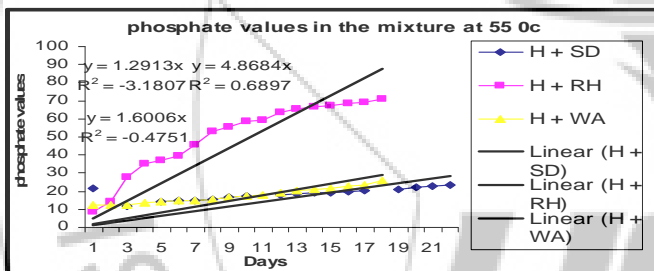


Figure 3.19: Phosphate values in the mixtures at 55^o c

3.9.3 Degradation of Potassium

From the figure 3.21 and 3.22 it was very clear that the potassium values in wood ash are high at both the temperatures. Rick husk though shows higher values than saw dust at 55^o c Celsius, has similar values at room temperature.

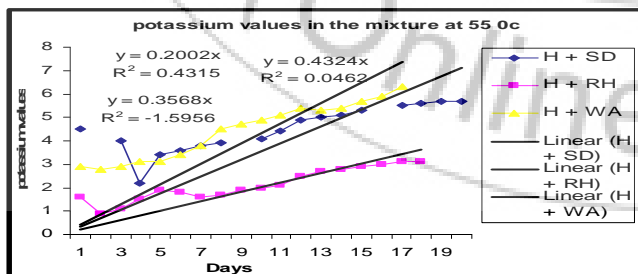


Figure 3.21: Potassium values in the mixtures at 55^o c

3.10 Multiple Regressions Co-efficient

Table 8: Multiple Regressions Equation with Co-efficient

The Degradation Equation					Regression co-efficient		
Variables	Y	X1	X2	X3	R	R2	
N	At	2.	1	1.	2.	0.99	0.99
		95	98	01	746	493	
P	55 ^o c	3.	1	1.	2.	0.99	0.98
		62	54	62	239	483	
K		3.	1	1.	2.	0.97	0.95
		57	65	61	918	878	
N	At	2.	1	0.	1.	0.99	0.98
		81	96	92	170	645	
P	Room	3.92	1	1.	2.	0.99285	0.98576
		98	92				
K	Temp	3.61	1	0.	2.	0.98134	0.96303
		68	50				

This equation gives a fair idea as to how the degradation takes places at different temperatures in various additives. Tables show the values of multiple regression equation of NPK degradation of humanure with various additives at 55^o Celsius and at room temperature.

3.11 Descriptive Statistics

Descriptive statistics was applied to the values obtained to know the mean, median, mode and standard deviation values. The tables 1, 2 and 3 shows the descriptive statistics of Humanure with saw dust, Humanure with Rice Husk and Humanure with wood ash respectively.

Table 9: Descriptive Statistics for Humanure + Saw dust

	Min	Max	Mean	SD	No of samples
No of days	1	22.	12.	06.	18
Nitrates at 55 o C	69.	145.	115.	24.	18
	63	5	24	88	
Nitrates at RM	66.	105.	85.	13.	18
	54	7	87	48	
Phosphates at 55 o C	11.	23.	18.	03.	18
	93	61	47	31	
Phosphates at RM	13.	41.	31.	08.	18
	67	47	26	31	
Potassium at 55 o C	02.	05.	04.	00.	18
	20	70	54	94	
Potassium at RM	01.	05.	04.	01.	18
	50	40	11	17	

Table 10: Descriptive Statistics for Humanure +Rice Husk

	Min	Max	Mean	SD	No of samples
No of days	1	22.00	12.11	06.47	18
Nitrates at 55 ° C	07.46	61.22	22.41	11.23	18
Nitrates at RM	07.55	52.24	17.95	10.84	18
Phosphates at 55 ° C	08.89	70.80	52.84	18.12	18
Phosphates at RM	09.65	76.45	50.01	20.86	18
Potassium at 55 ° C	00.10	03.20	02.07	00.81	18
Potassium at RM	01.70	05.90	04.63	01.34	18

Table 11: Descriptive Statistics for Humanure + Wood ash

	Min	Max	Mean	SD	No of samples
No of days	01.00	22.00	12.11	06.37	18
Nitrates at 55 ° C	9.920	28.43	18.21	06.09	18
Nitrates at RM	8.87	35.40	19.93	08.20	18
Phosphates at 55 ° C	12.1	25.76	17.55	04.18	18
Phosphates at RM	10.14	24.19	17.71	04.45	18
Potassium at 55 ° C	02.80	06.00	04.40	1.11	18
Potassium at RM	03.20	09.50	05.41	02.26	18

4. Conclusions

The following conclusions were drawn from the study:

- 1) The NPK values, organic carbon, organic matter in the soil after harvesting the crop were quite high and physical growth of plant was optimal on plots where Humanure and eco-fertilizers was applied, thus increasing the nutrient values and fertility of the soil.
- 2) The yield of the crops were highest on the eco-fertilizers plot, and Humanure amendments maintain soil aggregate stability and contribute to a soil's water holding capacity, benefit soil physical properties as well increased biological activity, enhancing the soil fertility on each application which in turn increase yield.
- 3) The application of eco-fertilizers is the best alternative. This also reduces the waste disposal consequences on the environment.
- 4) Experiments reveals that the additive saw dust shows high nitrate values at room temperature as well at 55 ° c, whereas rice husk and wood ash shows high phosphate and potassium values at above mentioned experimental temperature.
- 5) The optimal rate of degradation is found to be in nitrate at 55 ° c and at room temperature with multiple regression co-efficient being 0.99492 and 0.98645 respectively.
- 6) The optimal decay of phosphate and potassium was found to be at room temperature with the regression co-efficient being 0.9857 and 0.96302 respectively.

5. Future Scopes

- 1) The Eco-fertilizers can be treated with other household organic wastes to reap better nutrient values.
- 2) The Humanure can be used along with cow dung to produce bio-gas.

- 3) Eco-toilets can play an important role in rail and air ways; conserving the water, reducing the storage space of waste.

6. Acknowledgment

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