International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2015): 6.391

Sound Pollution Effect on the Germination, Growth and Yield Rate of Some Potted Plants

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Abstract: ***The concept of sustainable development has broaden the need to investigate the impact of our industrial and anthropogenic activities on the biota. This literally imply, the animals, plants. Microbes and the human element, using sound pollution as an index. Literature reviews reveals that past studies has been on impact of noise from traffic, electronics and engine source on human health and wellbeing. The focus of this study is to investigate the impact of environmental noise on plants which is part of the biota. The method involves conducting noise survey of the oil and gas industries in the Niger Delta which gave an average of 87dBA±5. The experimental site was chosen to be Nigerian Agip gas plant Port Harcourt and the control was chosen at the Eagles Island with an average noise level of 57dBA±5. The potted experimented plants are Zea maize SPA, vigna inguculata SPB and Arachis by Hypogea SPC, which were monitored for 15days intervals across four seasons. The analysis of variance shows no significant deference between growth rate at the experimental site and control for the 87dBA±5 noise level but observation indicate 6 to24 hours early sprouting at the experimental site and better vegetative yield but poor seed yield, possibly because the high tune noise prevented insect pollination and reducedlarver and other pest attack as against the control. There is no doubt that ultrasonic sound could have effect on plant but not environmental noise of 87dBA±5.***

1. Introduction

Human search for knowledge is a product of civilization, guided towards protecting the earth and ensuring sustainable development. The focus of the study is sound pollution effect on the plants within the intensity range of 87dBA±5. A lot of investigation has been done on possible noise effect on man by Stanfield and Matheson (2003). They documented that noise has adverse effect and can cartelize anxiety, stress, nervousness, nausea, headache, emotional instability, argumentative, sexual impotence, by distraction, changes in mood, increase in social conflicts, neurosis, hysteria and psychosis.These are however debatable because different persons have differentdefense mechanism, copping mechanism and adaptation, which affect the psychological evaluation. The study from a pressure definition as force per unit area in physics believe that if pressure is the measure of concentration, then over tasking the sense organ of hearing with fluctuating noise can reduce work performance and learning rate. This is because of the spectra of divided attention, which issynonymousto increase area, which reduces pressure. The processinvolves theneuroendocrine system which can lead to a lot of reflex actions, annoyance, forgetfulness and involuntary actions which may lack rationales.

Other studies in the area of airport, industrial, motor traffic and environmental noise includes;

Babisch (2000), Babisch et al. (2005), Belojevic et al. (2008), Boden (2009), Chakraborty et al. (1998), Dutta (2006), Gorai and Pal (2006), Guasch et al. (2002), Gundogdu et al. (2005), Lundbery (1999), Mato and Mufuruki (1999), Neuman et al. (2010),Pachpande et al. (2005), Peter et al. (2008), Piccolo et al., (2005), Prasher (2003), Rao et al. (2004), Seligman et al. (2001), Stansfeld et al.(1996), Tang and Wang (2007), Xim et al. (2000), Zanin et al. (2003), Jakovljevic et al. (2006), Stansfeld and Matheson (2003) etc. None of these studies looked at noise impact on the plants which this study hopes to investigate since they all belong to same biota and are important for the sustainability of the earth and life on earth.

2. Method

The research method include the use of digital noise meter to determining the ambient noise level within the oil and gas flow stations in the Niger Delta sub-region of Nigeria. 5 liter volume of plastic containers were perforated under and filled to 75% with a composite of sharp sand humus and silt and flush drained until the soil consolidate.Some selected seed of Zea maize, Vignaunguiculata (beans) and Arachis hypogea were introduced into the pot to a depth of 100mm, and watered both morning and evening while monitoring the environmental condition and air quality by high volume sampler and impingeset for the suspended particulate matter and other chemical pollutants, which were similar to both sites because of the discharge velocity ofthe plume jet from the generatorexhaust. The temperature at the experimental site was 2^0C above the ambient 30^0C at the control but this was stepped down by running a jet of water over the 175KVA generators which are expected to run concurrently through the 9 month to 15 month experimental duration. A measuring tape was used to measure growth lengthfor each day after the germination record and the result is as shown in

3. Results

The result of the experiment are shown in tables 1, 2, 3, respectively for Zea maize (SPA) Vigna ungulculata (SPB) and Araches Hypogea (SPC) index.

ZEA MAIZE (SPA)

Table1: Showing Summary Account of Growth Rate of Zea Maize

Specimen ⇓	Days ⟹	3	4	5	6	7	8	9	10
Jan. 2016	SPA Treated 1	0.1	1.2	3.4	3.8	5.6	7.1	8.8	9.3cm
	SPA Control 1	0.2	1.3	3.3	4.2	5.8	7.2	8.8	9.4cm
Apr. 2016	SPATreated 2	0.6	1.8	3.6	4.4	5.8	7.5	8.6	1.2cm
	SPA Control 2	0.4	1.8	3.4	5.0	6.2	7.6	8.4	10.0cm
Sept. 2016	SPA Treated 3	0.2	1.4	3.2	4.8	5.9	7.0	8.2	9.0cm
	SPA Control 3	0.5	1.6	3.0	4.9	5.9	7.0	8.2	9.2cm
Jan. 2017	SPA Treated 4	0.0	0.7	1.6	3.2	4.6	6.5	7.2	8.4cm
	SPA Control 4	0.0	1.2	1.0	1.8	3.8	5.9	6.6	7.8cm
Jul. 2017	SPA Treated 5	0.4	1.6	3.2	4.3	6.0	7.2	8.5	9.3cm
	SPA Control 5	0.1	1.2	2.8	4.0	6.1	7.3	8.5	9.2cm
Sum∑	**SPA Treated**	**1.3**	**6.7**	**15.0**	**20.5**	**28.1**	**35.2**	**40.9**	**46.2cm**
Sum ∑	**SPA Control**	**1.2**	**6.1**	**13.5**	**19.9**	**27.8**	**35.0**	**40.5**	**45.6cm**

Growth Length in Cm ⟶

VIGNA INGUICULATA (SPB)

Table 2: Showing summary account of growth rate of Vigna inguiculata

Specimen ⇓	Days ⟹	3	4	5	6	7	8	9	10
Jan. 1996	SPA Treated 1	1.2	3.3	5.0	7.0	7.9	9.2	10.1	11.8cm
	SPA Control 1	0.8	3.2	5.1	6.8	7.8	9.3	10.0	11.6cm
Apr. 1996	SPA Treated 2	2.2	3.6	5.2	6.9	7.8	9.6	10.8	12.3cm
	SPA Control 2	1.0	3.4	5.2	7.2	8.0	9.8	11.2	12.6cm
Sept. 1996	SPA Treated 3	1.8	3.4	5.0	6.8	8.4	9.6	11.0	12.2cm
	SPA Control 3	1.2	3.3	4.8	6.2	8.2	9.4	11.2	12.0cm
Jan. 1997	SPA Treated 4	0.8	2.2	3.8	5.6	6.8	7.6	10.2	11.3cm
	SPA Control 4	0.2	1.8	3.3	5.4	6.9	7.8	10.4	11.3cm
Jul. 1997	SPA Treated 5	1.6	2.8	4.3	6.9	8.0	10.2	11.1	12.1cm
	SPA Control 5	1.0	2.2	4.2	7.2	8.1	10.4	11.5	12.5cm
Sum ∑	SPA Treated	7.6	15.3	23.3	33.3	38.8	46.2	53.2	59.7cm
Sum ∑	SPA Control	4.2	13.9	22.6	32.8	39.0	46.7	54.3	60.0cm

Growth Length in Cm ⟶

SPC ARACHIS HYOHEA

Table 3: Showing summary account of growth rate of Vigna inguiculata

Specimen ⇓	Days ⟹	3	4	5	6	7	8	9	10
Jan. 1996	SPA Treated 1	0.0	0.5	1.8	3.3	4.8	5.4	5.7	6.0cm
	SPA Control 1	0.0	0.1	1.2	2.0	7.8	9.3	10.0	11.6cm
Apr. 1996	SPA Treated 2	2.2	3.6	5.2	6.9	7.8	9.6	10.8	12.3cm
	SPA Control 2	1.0	3.4	5.2	7.2	8.0	9.8	11.2	12.6cm
Sept. 1996	SPA Treated 3	1.8	3.4	5.0	6.8	8.4	9.6	11.0	12.2cm
	SPA Control 3	1.2	3.3	4.8	6.2	8.2	9.4	11.2	12.0cm
Jan. 1997	SPA Treated 4	0.8	2.2	3.8	5.6	6.8	7.6	10.2	11.3cm
	SPA Control 4	0.2	1.8	3.3	5.4	6.9	7.8	10.4	11.3cm
Jul. 1997	SPA Treated 5	1.6	2.8	4.3	6.9	8.0	10.2	11.1	12.1cm
	SPA Control 5	1.0	2.2	4.2	7.2	8.1	10.4	11.5	12.5cm
Sum ∑	**SPC Treated**	**0.0**	**3.0**	**8.4**	**15.8**	**24.5**	**28.6**	**30.3**	**32.2cm**
Sum ∑	**SPC Control**	**0.0**	**1.0**	**6.1**	**11.3**	**21.9**	**26.5**	**29.1**	**31.0cm**

Growth Length in Cm ⟶

SP (A, B, C) Grand Mean

Table 4: Showing the Grand Mean of the Growth Rate of Experiment on Plant Growth

Specimen/Days	3	4	5	6	7	8	9	10
∑SPA Treated	1.3	6.7	15.0	20.5	28.1	35.2	40.9	46.2
∑SPA Control	12	6.1	13.5	19.9	27.8	35.0	40.5	45.6
∑SPB Treated	7.6	15.3	23.3	33.2	38.9	46.2	53.2	59.7
∑SPB Control	4.2	13.0	22.6	32.8	39.0	46.7	54.3	60.0
∑SPC Treated	0.0	3.0	8.4	15.8	24.5	28.6	30.0	32.0
∑SPC Control	0.0	1.0	6.1	11.3	21.9	26.5	29.1	31.0
Grand Sum ∑SP Treated	8.9	25.0	46.7	69.5	91.5	110.0	124.4	138.1
Grand Sum ∑SP Control	5.4	21.0	4.22	6.40	88.7	108.2	123.9	136.6

Growth Length in Cm⟶

Analysis of sound Pollution Effect on the Germination and Growth Rate of Some Potted Plant

Table 5: Sound Pollution Effect on theGermination and Growth Rate of Zea Maize(Spa)

	Specimen	Mean ± SD	p-value	Remark
Jan 2016	Treatment Control	4.91 ±3.38 5.03 ±3.37	0.95	Not Significant
Apr 2016	Treatment Control	4.19 ±2.95 5.35 ±3.33	0.047	**Significant**
Sept 2016	Treatment Control	4.93 ±3.11 5.04 ±3.13	0.94	Not Significant
Jan 2017	Treatment Control	4.03 ±3.15 3.51 ±2.94	0.74	Not Significant
Jul 2017	Treatment Control	5.06 ±3.23 4.90 ±3.49	0.92	Not Significant

Summary: Analysis of variance (ANOVA) carried out showed that there is no significant difference in the Sound Pollution Effect on thegermination and growth rate of ZEA maize between the treatment and control group for the various months considered except for April 1996 which showed a significant difference between the treatment group and the control group.

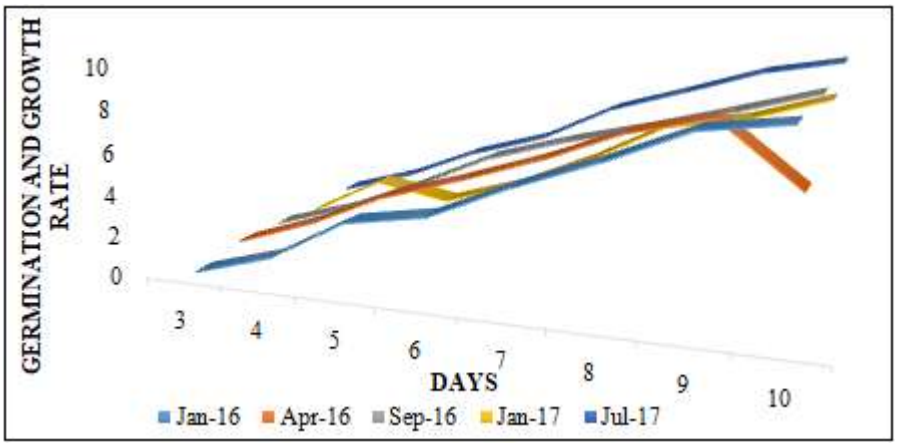

Figure 1: Graph showing the germination and growth rate of ZEA MAIZE over various days sampled out for different months of the year

Table 6: Sound Pollution Effect on the Germination and Growth Rate of Vigna unguiculata

	Specimen	*Mean ± SD*	*p-value*	*Remark*
Jan 2016	Treatment Control	6.94 ±3.58 6.83 ±3.63	0.95	Not Significant
Apr 2016	Treatment Control	7.30 ±3.53 7.30 ±3.95	1.00	Not Significant
Sept 2016	Treatment Control	7.28 ±3.69 7.04 ±3.83	0.90	Not Significant
Jan 2017	Treatment Control	6.06 ±3.72 5.89 ±3.97	0.93	Not Significant
Jul 2017	Treatment Control	7.13 ±3.93 7.14 ± 4.31	0.10	Not Significant

Summary: Analysis of variance (ANOVA) carried out showed that there is no significant difference in theEffectof Sound Pollution on thegermination and growth rate of Vigna unguiculata between the treatment and control group for the various months considered.

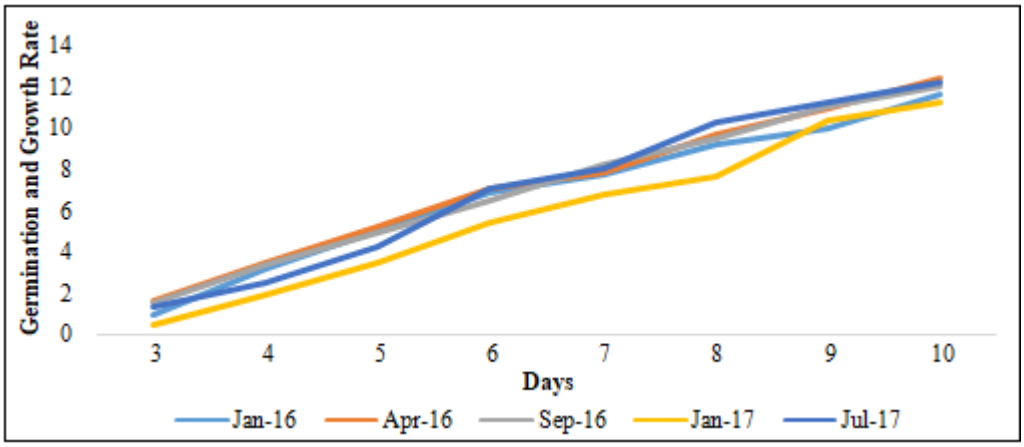

Figure 2: Graph of the germination and growth rate of Vigna unguiculata over various days sampled out for the study

Table 7: Sound Pollution Effect on theGermination and Growth Rate of Arachis hypogea

	Specimen	*Mean ± SD*	*p-value*	*Remark*
Jan 1996	Treatment Control	3.44 ±2.41 2.95 ±2.41	0.69	Not Significant
Apr 1996	Treatment Control	3.50 ±2.54 3.69 ± 2.70	0.89	Not Significant
Sept 1996	Treatment Control	3.85 ±2.89 3.18 ±2.81	0.64	Not Significant
Jan 1997	Treatment	3.14 ±2.46	0.81	Not Significant
	Control	2.84 ±2.40		
Jul 1997	Treatment Control	3.93 ± 2.59 3.21 ± 2.52	0.59	Not Significant

Summary: Analysis of variance (ANOVA) carried out showed that there is no significant difference in the sound pollution effect on the germination and growth rate ofArachis hypogeabetween the treatment and control group for the various months considered.

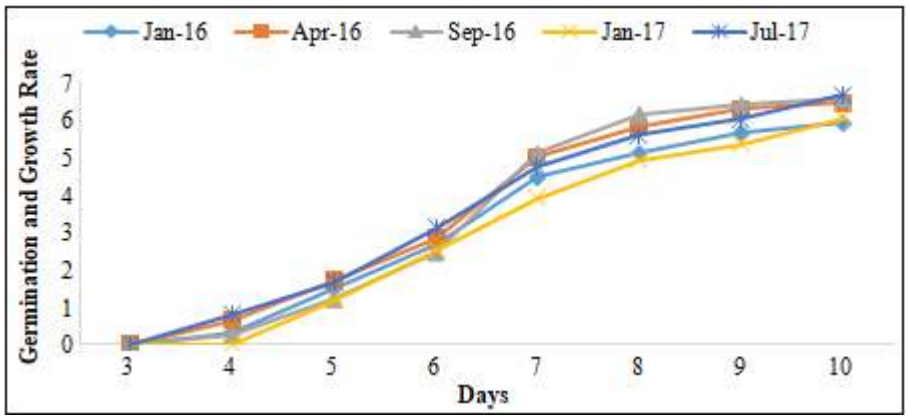

Figure 3: Graph showing the germinationandgrowth rate of Arachis Hypogea over various days sampled out for the study

4. Summary and Conclusion

A lot of study has been conducted to find sound pollution effect on human being. This study focuses on sound pollution effect on the plants. The analyses of variance show that there is no sound pollution effect on the growth rate of the plants at the experimental site 87dBA ± 5 and the control site 57 ± 5dBA. There is an observable 6 to 24 hours early sprouting at the experimental site. The leaves at the experimental site where not attacked by pest nor laver and looks fresher but on the revers the crop yield at the control was more about 15grams per kilo vegetation possibly due to the absence of insect pollinating agent at the experimental site because of the noise level. The conclusion is that noise of 87dBA ± 5 can reduce reproduction and plant yield because of the secondary impact on the microbes, and insect pollination but no significant difference in the growth rate as soon as germination is established.

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