Assessing Constituents and Efficiency of Neem Seeds Powder (*Azadirachtaindica A. Juss*) modifying Soil physical and Chemical Properties

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Abstract— *Neem is an indigenous tree spreading over some tropical arid climatic area. The trees are carrying fruits containing seeds. The importance of this study is to identify the benefits gained from Neem seeds powder being applied as soil conditioner. The objective is to estimate the inherent chemical components of Neem powder and eventually assess its potential on decreasing soil pH values and salinity levels. Soil samples were collected from College of Agricultural Studies, Sudan University of Science and Technology (SUST). A total of 6 kilogram soil was taken at a depth of 0-30cm from the soil surface, dried and grinded to pass 2mm sieve, divided equally into 4 groups each of 1.5Kg (equivalent to 1500mg). The soil samples were analyzed to determine their chemical and physical properties. Neem seeds were obtained from Department of Integrated Pest Management that belongs to the Institution of ENRDRI. Neem seeds are dried, grinded and kept under room temperature, further used for determine their physical and chemical properties. To each subsoil sample (1.5Kg.) and amount of 0g, 25g, 50g and 75g Neem seeds powder was added and thoroughly mixed. Each of the 4 soils- Neem seeds powder mixture was subdivided into 15 pots, each containing 10mg of the mixture. The experiment ended up with 3 different treatments and the control. After 14 week incubation, the soil- Neem mixtures were analyzed for pH and Ec. At 25% Neem seeds powder, pH recorded values ranging from 7.22-7.99, and values of 7.47-7.89 were for Neem seeds powder of 50% and 75% respectively. Variation in electrical conductivity among different treatments recorded different values according to change in Neem seeds contents. At 25%, electrical conductivity values ranged from 0.22-0.33, at 50% and 75% recorded 0.17-0.28, and 0.17-0.28 respectively, while being 0.22-0.32 in the control. Results showed that the soil pH and electrical conductivity have decreased with increasing Neem seeds powder. Also on conclusion, the results indicated that Neem seeds powder can be used as organic amendment for saline and alkaline soil.*

Keywords— Amendment, Organic fertilizer, soil pH, Salinity, Neem seeds powder.

I. INTRODUCTION

Neem is recognized today as a natural product which has much to offer in solving global agricultural, environmental and public health problems. Researchers worldwide are now focusing on the importance of Neem in the agricultural industry(Subbalakshmi *et al.,* 2012).The most important part of the tree is Neem seeds containing oil and many active molecules (Vethanayagam *et al.,* 2010). Neem seed has been used as a soil amendment in many studies in India (Gardening abc., 2013; Debashri *et al.,* 2012). Neem seeds residue provided some substances i.e. nitrogen, after oil extraction, of 7% and at a release rate fast enough to satisfy maize nutrition (Agbenin *et al.,* 2012). That is why special attention is paid to the seeds. However, research on the seeds has increased since the isolation of *azadirachtindica* as a natural in secticide (*Butterworth J.H. and Morgan F.D.,* 1968). Neem seed granules or powdered seeds are used to manufacture as soil conditioner (Moslem *et al.,* 2009). It can be applied during sowing of plants or can be sprinkled and raked into the soil. The process of sprinkling should be followed by proper irrigation so that the product reaches the roots. It is a natural soil conditioner that helps improve the quality of soil, thereby enhancing the growth of plants and fruits (). Neem soil conditioner application in plantation crops is known to be a soil enhancer that helps increase its fertility (Subbalakshmi *et al., 2012*; Abdel-Rahman, G. (2009)). Neem manure is gaining popularity because it is an environmental friend; and also the compounds found in it help increase the nitrogen and phosphorous content in the soil. It is rich in sulphur, potassium, calcium, nitrogen, etc. (Subbalakshmi *et al.,* 2012). Neem seeds powder can be a of great benefits if you are considering decreasing soil pH and reducing the alkalinity of the soil as it gets mixed with the soil and produce organic acids (Gardening abc., 2013).

II. MATERIALS AND METHODS:

2.1 Soil and Neem Preparation

Soil sample at a depth of (0-30) cm was collected from College of Agricultural Studies, Sudan University of Science and Technology (SUST), (Shambat), and then ground to pass through 2 mm sieve, dried by air under room temperature for 24 hours.

Neem seeds were obtained from Department of Integrated Pest Management that belongs to the Institution of ENRDRI. The seeds were kept under room temperature.

2.2 Pot Experiments

Pot experiments conducted, first divided 6000 gm soil into 4 weights, then added 25g, 50g, 75g of Neem seeds powder to each soil weight (1500gm) and mixed. The each mixture distributed to 15 pots each pot contents 10 gm of mixture. Constitute three different treatments and control.

2.3 Soil Extract Preparation (SEP)

Soil extract (1:5) was prepared when adding 100 ml distilled water to 50 g soil, shacked for 30 minutes and then filtered.

2.4 Soil pH and salinity

Soil pH and soil salinity were measured using pH "meter Hanna model 211" and electrical conductivity "meter Hanna model 214" respectively .

2.5 Applications of Neem seeds powder:

From the soil samples3 weights of Neem seed powder (N1 =25g, N2=50g, N3=75g), were added to 1500 g of soil which was used as the experimental. Each fertilizer was added alone in a separate pot with a diameter 10 inches and a control treatment without addition of any fertilizer was tested, for each treatment.

III. RESULTS

3.1 Physical characteristics of Neem seeds

The physical characterization of Neem seeds revealed that the average mass of a seed is 1 g. It is composed of 50.89% for the kernel, and 49.11% for the skin as shown in Table 1.

TABLE 1
SUMMARIZE THE PRE-PHYSICAL CHARACTERISTICS OF NEEM SEEDS

Neem Seeds Composition					
Skin values		**Cortex values**		**Kernel values**	
g	%	g	%	g	%
3.3	33%	3.7	37%	3	30%
3.2	32%	3.8	38%	3	30%
3.3	33.6%	3.7	37%	2.8	28.5%
3.2	32.9%	3.9	39%	2.6	26.8%

The result in Table (1) showed contents of Neem seeds composed of skin, cortex and kernel (in g or %) as follows 32.9, 39% and 26.8% respectively.

TABLE 2
SUMMARIZE THE PRE-CHEMICAL ANALYSIS OF NEEM SEEDS POWDER

Sample	DM%	Ash%	EE%	CF%	CP%	N%	NFE
Skin	94.0	8.6	14.25	23.05	6.12	0.97	47.98
Kernel	95.4	3.4	26.0	24.5	11.1	1.77	35.0
Cakes	95.6	4.1	8.5	25.6	13.5	2.16	48.3

DM: Dry Matter; CP: Crude Protein; N: Nitrogen; CF: Crude Fiber; EE: Ethel Extract; NFE: Nitrogen Free Extract. Methods of Analysis are based on (AOAC, 1980).

The Results of Table (2) explain chemical analysis of Neem seeds parts skin , kernel and cakes recorded total nutrients contents of dry matter 94,95.4,96.6% respectively then ash 8.6 highest in skin,3.4 in kernel,4.1lastely in cakes, either extract show that 14.25 in skin then 26.0 highest result in kernel last 8.5 in cakes, crude fiber contents 23.05 at skin, 24.5 in kernel and 25.6 in cakes, crude protein show that 6.12 in skin then 11.1 in kernel and 13.5 in cakes the high result, nitrogen results in skin 0.97 then kernel 1.77 and the highest one at cakes 2.16. The composition shows nitrogen free extract 47.98 in skin then 35.0 in kernel and 48.3 in cakes.

TABLE 3
EFFECT OF NEEM POWDER TREATMENTS ON MEASURED SOIL PH

Treatments	Number of Weeks after Incorporation						
	2	4	6	8	10	12	14
	pH	pH	pH	pH	pH	pH	pH
Control	7.27	8.16	8.05	7.88	7.84	7.29	7.72
1500/25	7.83	7.72	7.99	7.74	7.47	7.47	7.22
1500/50	7.79	7.75	7.80	7.32	7.72	7.44	7.42
1500/75	7.54	7.75	7.84	7.52	7.61	7.47	7.44

Measurements for pH show that the 25% Neem seed powder, recorded values between (7.22-7.99) then (7.32-7.80) and (7.47-7.84) at concentration 50% and at 75%, respectively compared with control (7.27-8.16).

TABLE 4
SIGNIFICANCE OF NEEM POWDER TREATMENTS DURING 14 WEEKS

Treatment	Period (weeks)						
	2	4	6	8	10	12	14
25g NSP	7.83 a	7.73 b	7.98 ab	7.74 a	7.46 c	7.47 a	7.22 c
50 g NSP	7.79 a	7.75 b	7.81 b	7.31 c	7.72 ab	7.44 a	7.42 b
75 g NSP	7.54 b	7.74 b	7.84 ab	7.52 b	7.60 bc	7.47 a	7.44 b
Control	7.26 c	8.16 a	8.04 a	7.82 a	7.83 a	7.28 a	7.72 a
SE	0.06	0.11	0.10	0.05	0.06	0.04	0.07

Means followed by the same letters within columns no significant different at ($P \leq 0.05$), according to Duncan's multiple. NSP: Neem Seeds Powder.

TABLE 5
EFFECT OF NEEM POWDER TREATMENTS ON ELECTRICAL CONDUCTIVITY (EC)

Treatments	Electrical Conductivity (Ec)					
	Period (weeks)					
	1	2	3	4	5	6
Control	0.22	0.32	0.22	0.26	0.33	0.29
1500/25	0.20	0.17	0.17	0.17	0.28	0.24
1500/50	0.17	0.23	0.14	0.30	0.30	0.35
1500/75	0.42	0.32	0.19	0.37	0.31	0.38

The variation in electrical conductivity values among different treatments recorded different concentrations of Neem seed powder, at 25% it range between (0.22-0.33), then 50% between (0.17-0.28) and lastly 75% recorded (0.19-0.42) compared with control (0.22-0.32).

TABLE 6
EFFECT OF NEEM POWDER TREATMENTS ON ELECTRICAL CONDUCTIVITY

Treatment	Period (weeks)					
	2	4	6	8	10	12
25g NSP	0.15 lm	0.17 kl	0.17 kl	0.17 kl	0.27hi	0.23j
50 g NSP	0.17 kl	0.23 j	0.14 m	0.30 fgh	0.30 fgh	0.23j
75 g NSP	0.42 a	0.32 ef	0.19 k	0.37 bc	0.31efg	0.38 b
Control	0.22 j	0.32 ef	0.22 j	0.26j	0.33de	0.29ghi

Means followed by the same letters no significant different at (P≤0.05), according to Duncan's multiple.

IV. DISCUSSION

Results from incubation period showed that there was a significant difference soil electrical conductivity (P≤0.05), and pH (P≤0.05) in compared to the control as explained in Tables (3-6). In fact, result of the experiment showed a great decreasing in soil electrical conductivity during the incubation period. However, in the first week, the lowest soil electrical conductivity was (0.17dS/m) recorded in the treatment with 50g of Neem powder followed by (0.20dS/m) recorded at 25g, while the highest value was (0.42dS/m) recorded in the treatment with 75g of Neem powder compared to the control (0.22dS/m). Similar results were found in the second weeks as well as the rest of weeks from incubation of Neem powder to the soil samples. Among all weeks the lowest electrical conductivity was obtained in third weeks from incubation in 50g Neem powder as explained in Table (5). Its values were lower by almost 36.4% than control. This finding is in agreement with finding of Oyinlola *et al.,* (2017), they mentioned that Neem seed cake has positive effect on soil chemical properties, when studied the effect of Neem seed cake and inorganic fertilizers on tomato yield and soil properties in northern Guinea savanna of Nigeria. In contrast, our findings disagree with finding of Elnasikh *et at.,* (2011), they profound that Neem seed cake significantly increased electrical conductivity when studied impact of Neem seed cake on soil microflora and some soil properties at Elrawkeeb station. As well as the findings of Lubungo A., (2015), when they studied the effect of aqueous Neem leaf extract on selected soil chemical and biological properties in Zambia. We attribute that to microbial activities, and Neem seed cake properties and amounts. Similarly, soil pH values were below the control Table 3, whereas, in the first week was high by almost 3.5%. After the second week of the incubation soil pH values were observed to decrease by almost 5% in comparison to the control. These findings in accordance with Lubungo A., (2015), he observed that Neem leaf extract changes the soil from weak alkaline to alkaline.

V. CONCLUSION

The results proved that Neem seeds powder can be used as an effective organic amendment for saline and alkaline soil.

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