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RESEARCH ARTICLE

EVALUATION OF BIOWASTE, CHEMICAL FERTILIZERS AND NATURAL FERTILIZERS AND FUELS ON GERMINATION OF SEEDS

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ABSTRACT

Different germination experiments were carried to evaluate the germination and seedling growth by different type of synthetic fertilizers and also studied the impact of fuels on germination. The soil was treated with urea, cow dung, vermin compost, oil, petrol, charcoal wood chips and DAP. The results showed germination is enhanced in case of wood chips, vermi compost, charcoal added soil samples. The urea and oil are not favourable for germination. DAP showed favourable results to certain extent only.

INTRODUCTION

Soil or pedosphere is a mixture of minerals, organic matter, gases, liquids, and countless organisms that together support life on Earth. Soil is called the Skin of the Earth (Miller, 1953), and interfaces with the lithosphere, the hydrosphere, the atmosphere and the biosphere. Soil formation or pedogenesis is the combined effect of physical, chemical, biological and anthropogenic processes working on the soil parent material. Soil has different functions and it serves as media for growth of all kinds of plants, it modifies the atmosphere by emitting and absorbing gases (carbon dioxide, methane, water vapor) and dust, provides habitat for animals and organisms (such as bacteria and fungi), absorb, hold, release, alter and purify most of the water in terrestrial systems, process recycled nutrients, including carbon so that living things can use them over and over again and also serve as engineering media for construction of foundations, roadbeds, dams and buildings and preserve or destroy artifacts of human endeavors.

Soilcomposition: Soil is a complex body composed of five major components namely mineral matter obtained by the disintegration and decomposition of rocks, organic matter obtained by the decay of plant residues, animal remains and microbial tissues, water obtained from the atmosphere and the reactions in soil (chemical, physical and microbial), air or gases from atmosphere, organisms both big (worms, insects) and small microbes. To enhance the fertility of soil, fertilizers are added.

They have the following nutrients in varying proportions:

Three main macronutrients- 1. Nitrogen (N): for leaf growth 2. Phosphorus (P): for development of roots, flowers, seeds, fruit 3. Potassium (K): for strong stem growth, movement of water in plants, promotion of flowering and fruiting, three

Secondary macronutrients: calcium (Ca), magnesium (Mg) and sulphur (S);

micronutrients : copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), zinc (Zn), boron (B) and of occasional significance there are silicon (Si), cobalt(Co), and vanadium (V) plus rare mineral catalysts (*Dittmar,* 2009). The macronutrients are consumed in larger quantities and are present in plant tissues in quantities from 0.15% to 6.0% on a dry matter (DM) basis. Plants are made up of four main elements: carbon, hydrogen, oxygen and nitrogen. Carbon, hydrogen and oxygen are widely available as water and carbon dioxide.

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Although nitrogen makes up most of the atmosphere, it is in a form that is unavailable to plants. Nitrogen is the most important fertilizer since nitrogen is present in proteins, DNA and other components (e.g., chlorophyll). To be nutritious to plants, nitrogen must be made available in a "fixed" form. Only some bacteria and their host plants (notably legumes) can fix atmospheric nitrogen (N_2) by converting it to ammonia. Phosphate is required for the production of DNA and ATP, the main energy carrier in cells as well as certain lipids. Micronutrients are consumed in smaller quantities and are present in plant tissue in the order of parts-per-million (ppm), ranging from 0.15 to 400 ppm DM or less than 0.04% DM (*Aesl.ces.uga.edu;* Mills; 1996). These elements are often present at the active sites of enzymes that carry out the plant's metabolism.

Soilpollution

Soil contamination or soil pollution as a part of land degradation is caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment. Soil pollution can be caused by oil drilling, mining and activities by other heavy industries, accidental spills as may happen during activities, corrosion of underground storage tanks (including piping used to transmit the contents), acid rain (in turn caused by air pollution), intensive farming, agrochemicals such as pesticides, herbicides and fertilizers, industrial accidents, road debris, drainage of contaminated surface water into the soil, waste disposal, oil and fuel dumping, nuclear wastes, direct discharge of industrial wastes to the soil, landfill and illegal dumping, coal ash, electronic waste, ammunitions and agents of war.

METHODS AND MATERIALS

Materials

Red soil, petrol, vermicompost, wood chips, charcoal, oil, petrol, urea, DAP, cowdung, pH meter, conductivity meter, pH 4 and 9 tablets, digital balance.

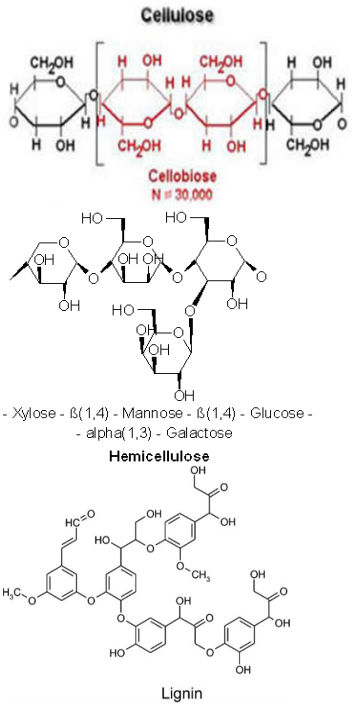
Method

Red soil was divided into 9 samples of 750 gms each. In each sample 75 gms of wood chips, charcoal, vermicompost, oil, urea, DAP, cow dung and petrol were mixed individually. These mixtures were kept in dark for one day. One sample was kept as a control without mixing anything in it. Then from each mixture 25 gms was taken and its conductivity and pH (at 7 and 9 pH) were measured. Each sample was further divided into 3 parts (each of approximately 275 gms) and seeds of Vigna radiata, Trigonella foenum-graecum and Brassica juncea were sown in each part. The growth of these plants was observed for 21 days. The length of each plant was observed in all samples and the height was recorded in centimeters.

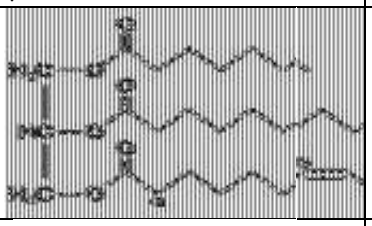
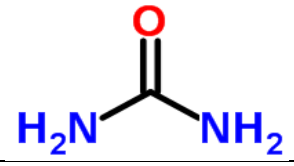
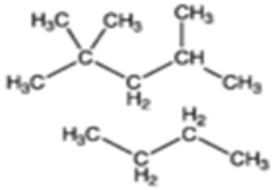
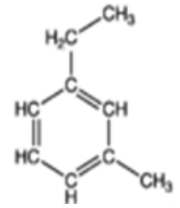
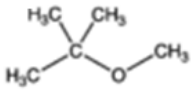
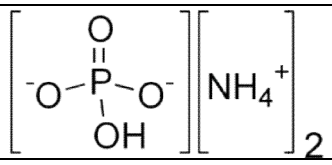
RESULTS AND DISCUSSIONS

Graph 1 represents the growth of Vigna radiata in 21 days. In control samples, the growth of Vigna radiata is only 9.8cms but in charcoal, wood and vermicompost samples the growth was doubled which indicates favorable condition for Vigna radiata in them. These materials enhance the growth and modify the soil behavior. Their introduction in the soil helps to improve fertility of soils because of physico-chemical properties such as high porosity and high surface area.

Table1. Composition Of Materials

S.No	Materials	Description	Components	Structure	Chemical Composition
1.	Woodchips	Waste material obtained from timber depots of hyderabad	Cellulose, hemicelluloses , lignin and water[7]		C: 50%, O- 42% H-6%: N- 1% Other elements-1%

……Continue

2.	Charcoal	Black residue obtained made up of carbon and its compounds	Carbon ,silica nitrogen and phosphorous	Contains micro pores (2-50nm),Meso pores and pores(>50nm)micro pores of(.>2nm) .	
3.	Oil	Color less liquid which is less viscous than water	Triglycerides, mono glycerides , triglycerides, free fatty acids, phosphatides, sterols, fatty alcohols, fat-soluble vitamins.		
4.	Urea	It is a colorless, odorless solid, highly soluble in water, non toxic used as fertilizer			It has two – NH_2 groups joined by a carbonyl (C=O) func tional group.
5.	Vermicom post	Vermi compost is a compost of the various species of worms, mixture of vegetable or food waste and bedding material	Used as organicfertiliser		
6.	Petrol		Hydrocarbons - alkanes with 4-10 carbon atoms , aromatic compounds, alkenes and alkynes	 Alkanes  Aromatic compounds  Other organic compounds	petrol - paraffins (15-60%) , naphthenes (30-60%) , aromatics (3-30%) , asphaltics(remainder). [25]
7.	Cow dung		3% -N, 2% P 1% Na /K(3-2-1 NPK) , undigested cellulose and lignin , bile salts, mucus, keratinized tissue and calcium salts from fatty acids[19] [20].		N-15 g/kg , P-10 g/kg , K-2g/kg , Mg-3 g/kg , Ca-0.57 g/kg , Na-0.54 g/kg , Cu- 20.5mg/g , Fe- 5.7 mg/g.
8.	Diammoni -um Phosphate (DAP)		Phosphorous and nitrogen.		18%-N 46%-P2O5(20%P).

Sometimes high pH associated with wood and charcoal helped to improve the fertility. Charcoal helps plants by improving the structure and chemistry of the soil as Charcoal increases the amount of water a soil can hold, and it improves soil pH, so the plant can get more nutrients from the soil. Charcoal also helps plants by soaking up toxic chemicals in the soil because Charcoal is full of tiny pores, like a sponge, so it can absorb pesticides, and chemicals secreted from the roots of noxious weeds. Charcoal helps plants by boosting the activity of beneficial fungi and bacteria in the soil as Charcoal enhances special fungi that infect a plant's roots and help it get more nutrients from the soil (http://www.bioed.org/ECOS/pubs/Presentations/CartoonIllustrations.pdf). Similarly vermin compost increased the fertility of soil and growth of Vigna radiata. Vermi compost obtained from earthworm castings has nutrients in significant quantity. It is naturally produced and its slow release and amendment increases the plant uptake of nutrients. It revealed that vermin compost applied crop showed slower growth in the beginning but as they slowly released the nutrients, plants picked up rapid

growth. The soil became softer, had good water holding capacity and healthy green leaves with multiple branching. The plant growth was also more in wood chips because of high porosity, high surface area, property of controlling soil temperature as well as prevention of invasion of weeds (Koski, 2004; Watson, 1988 and Sinkevičienė, 2009).

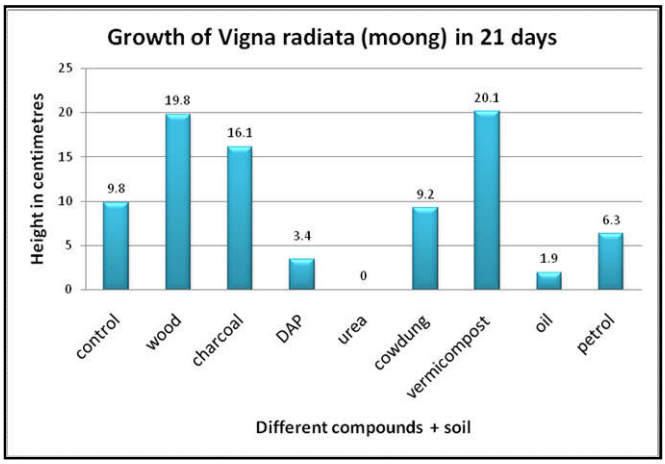


Figure 1.

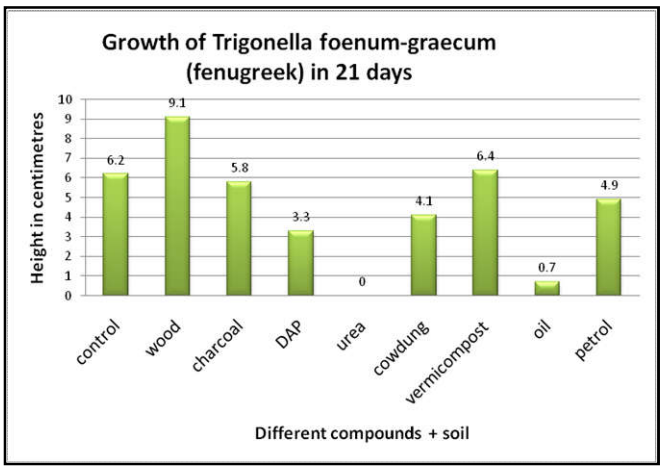


Figure 2.

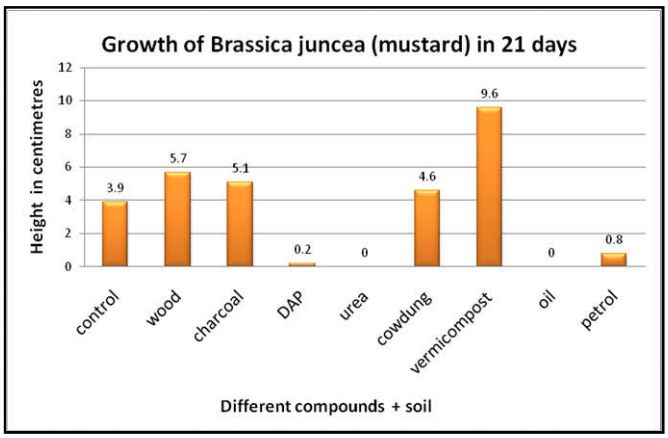


Figure 3.

Similar behavior was observed in control sample and cowdung manure samples. Cowdung manure is usually made up of digested grass and grain, rich in organic material and nutrients. The manure contains beneficial bacteria which help in slowly releasing the nutrients. It has a high cellulose content, provides sufficient NPK content. When urea and DAP were added the plant growth was not observed to a great extent and was lower than the control plant system. Numerous investigations have shown adverse effect in germination of seeds, seedling growth and early plant growth in excess urea added samples.

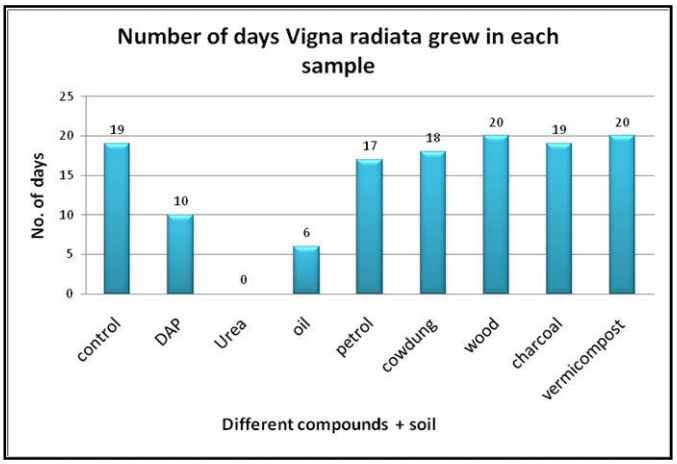


Figure 4.

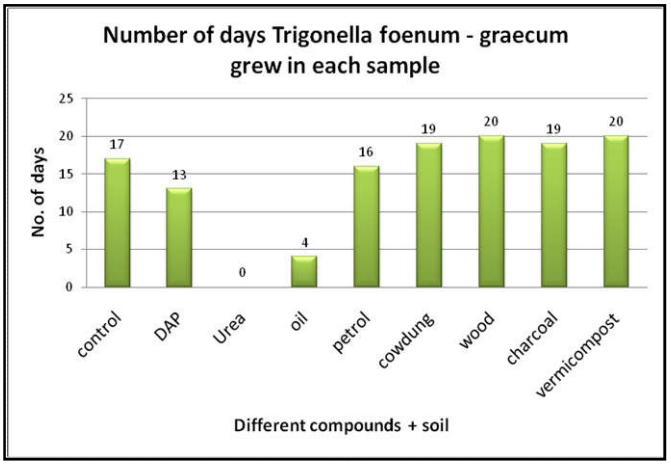


Figure 5.

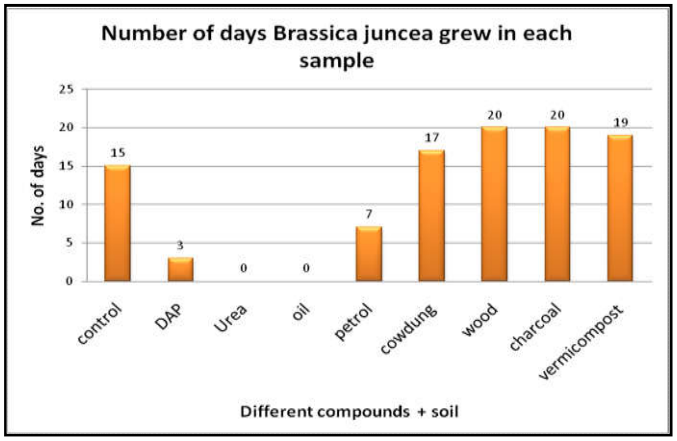


Figure 6.

This is due to ammonia formed through hydrolysis of urea by urease enzyme present in soil bacteria or due to nitrogen dioxide produced through nitrification of urea (http://www.extension.umn.edu/agriculture/nutrientmanagement/nitrogen/fertilizer-urea/). In DAP added soil samples also the growth rate was less than the control sample. For Vigna

radiata DAP is not suitable. The growth of Vigna radiata is also less in the soil sample with urea and petrol in comparison to the control samples. Addition of petrol leads to increased levels of nitrogen nitrate and nitrified ammonium sulphate levels and the soil pH increases upto 8 (http://www.uwm.edu.pl/ jold/poj1512010/jurnal-11.pdf). Its harmful effects include inhibition of seed germination, reduction of photosynthetic pigments; slow down of nutrient assimilation and shortening of roots and aerial organs. It is also expected that some fractions of petroleum can dissolve biological membranes and as a consequence, disrupt the plant root architecture. The soil structure, composition does not get modified instead it contaminates the sol affecting its physico-chemical properties. Heavy metals such as lead, iron and zinc are introduced by petrol and soil becomes coarse. The soils have low fertility, low productivity due to modification in their properties. Oil is a complex mixture of hydrocarbons like low molecular weight alkanes and polycyclic aromatic hydrocarbons. It contains sulphur, nitrogen and oxygen in low concentrations leading to the interference with hydric relations of the plant. Graph 2 represents the plant growth of Fenugreek in 21 days. The results of Fenugreek are similar to that of Vigna radiata. The growth in wood is highest in comparison to charcoal and vermicompost. But no much difference is observed giving a positive result indicating they are highly suitable for improving the soil fertility due to high water retention capacity, high porosity and surface area. Cowdung has less effect on fenugreek growth in comparison to Vigna radiata. Urea oil and petrol inhibited the growth of fenugreek. Due to the enzyme urease, breakdown of urea into ammonium ion and carbon dioxide occurred when urea was applied to soil and hence it becomes toxic for the soil. Graph 3 represents growth of Brassica juncea. Wood, Charcoal, Vermi compost and cow dung have shown favorable results in comparison to oil, petrol, DAP and urea. The percentage of growth in oil and urea is zero in comparison to petrol and DAP. There might be variation from species to species but he growth is almost similar upto 21 days. The figures 4, 5 and 6 represent the number of days of growth after germination. Maximum period of growth is observed in case of woodchips, charcoal, vermicompost which indicates that they increase the soil fertility and provide a favourable condition for growth. Urea and oil are not suitable for the germination of seeds. DAP favours the growth of plants to some extent.

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