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EFFECT OF THREE DETERGENTS (ARIEL, OMO AND SUNLIGHT) AND SODA ON THE GROWTH PROFILE OF SOYBEAN PLANT (*GLYCINE MAX*)

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ABSTRACT: *This study investigated the effect of detergents (ariel, omo and sunlight) and Soda on the growth rate of Soybean plant (Glycine max). Increase in mans' population brought about correspondence increase in basic amenities like water, food and housing. Lack of effective water supply led to the reuse of waste water for irrigation especially in rural areas deficient of adequate water supply. The need for environmental conservation necessitated the need to investigate the effect of this waste water constituent on soybean plants. The research was a pure experimental study of which ariel, omo, sunlight and soda were applied on soybean at 5 %, 10 %, 15 % and 20 % concentrations respectively with a replicate of two across the various concentrations used. The effects of these treatments were focused on plant height, leaf area, leaf number as well as on the wet and dry weight of soybean plant. Simple descriptive statistics was used to check the effect of these treatments on soybean plant. The result revealed that ariel and sunlight has a strong inhibiting effect on soybean plant but soda shows a promoter effect on soybean plant as it pertains to plant height, leaf number, leaf area as well as wet and dry weight of soybean plant.*

KEYWORDS: Soybean Plant, Leaf Number, Plant Height, Leaf Area, Detergents

INTRODUCTION

Conservation of the environment emphasizes the wise use of the environmental resources around us for continuous existence of species in the ecosystem. The ecosystem comprises of plants and animals whose populations are on the increase (Gross *et al.,* 2007). Increase in mans' population has led to an increase in the demand for the basic necessities of life including water. One basic consequence of population growth is the likelihood of water shortage which necessitates the reuse of wastewater (grey water) (Jury *et al.,* 2007). The reuse of waste water (grey water) appears as the right solution for rural and peri-urban areas without adequate water supply. Grey water includes all washing domestic water produced with the exception of the toilet water. This water results from the use of detergents, vegetable oils, soaps, and others kitchen and washing residue. This stand out to be a source of elevated levels of compounds such as surfactants, oils and salt which can alter soil properties, damage plants and contaminate groundwater (Travis *et al.,* 2008). When untreated waste water is used to irrigate plants growing in soil, the fate of surfactants in irrigated soil-plant systems is not well known (Misra *et al.,* 2012). Environmental study therefore becomes important so as to ensure the survival of plants for animals and human consumption. Although the government of today has shown a strong dissatisfaction over atmospheric pollution such as the release of chlorofluorocarbon into the atmosphere, no much emphasis has been paid on the release of detergents into the ecosystem and the effect it could have on our plants. The effects of these

substances should better be considered if we are to conserve our plants to ensure their continuous availability and increased produce.

This research is therefore designed to investigate the effect of detergents: (Ariel, Omo and Sunlight) and soda soap on the growth rate of soybean plant.

Soybean originated in South East Asia, it belongs to the leguminaceae family, a crop cultivated for its rich content in protein and oil and serve as a good source of protein for man and farm animals. It is also used as forage crop for feeding farm animals Tiwo (2004). The plant has also become very useful in food and drug industries. Detergents as a cleaning agent are known to contribute to the death of aquatic lives but no much work has been done on its effect on plant.

Detergents are amphipathic molecule that self-associate and bind to hydrophobic surfaces. Soap on the other hand is a compound of metal usually sodium or potassium and fatty acid. Example, caustic soda and tallow with the chemical name (sodium stearate). It is the first chemical to be used at home Martin (2009).

MATERIALS AND METHODS

Soybean of variety CIGRAS6 was bought at New Benin Market, Benin City. The soil (sandy loam) was collected behind School of Basic Medical Sciences, University of Benin, Benin city.

The black polythene bags that were used were bought from Santua horticultural garden in Benin City with small hole made underneath to prevent water logging.

The detergents and soda soap used were also bought from the same New Benin market. Other materials used include; measuring cylinder, 25 mls syringe, watering can, spade, pen and notebook, meter-rule, thread, weighing balance.

Experimental Design

Sixty (60) polythene bags were filled with sandy-loam; three grains of soybeans were planted in each bag. Four of these polythene bags served as control experiment each for the various treatments applied and were watered with water all through the experimental period. Four polythene bags on which treatments were applied with a concentration of 5 %, 10 %, 15 %, and 20 % in the three detergents (ariel, sunlight, omo) and soda had a replicate of two bags each. The set-up experiment was allowed to grow for three weeks before it was contaminated with the detergents and soda soap at the above stated concentrations.

Photographs of the set-up experiment was taken before contamination begins and at the end of the experiment.

Planting

The soil was filtered and dried to prevent any growth inhibitor; the seeds were soaked in water as a medium for selecting viable seeds. Any seed that floats was seen as bad and they were removed.

180 viable seeds were planted, 3 seeds per bag of 3 cm deep in a sandy-loam of soil weighing 1000 g. The bags were arranged in 5 roles and 3 columns.

Preparation of Treatment Solution

The concentration of the different detergent was prepared by weighing 5 g, 10 g, 15 g and 20 g of the different detergents and soda soap, each was diluted in 100 mls of water. The concentration obtained was applied by using 20 ml syringe. Before it was applied, the soil was open down to the root region with the help of the syringe to allow better penetration.

Determination of Growth Parameters

Plant height: This was obtained by using the meter rule to measure the plant from the soil level where the plant emanated from the ground.

Leaf area: This also was obtained by measuring the leaf length, leaf base and multiplying it.

Leaf area= leaf length× leaf base

Fresh weight: This was obtained by uprooting the plant carefully to avoid damaging the root. Then, the stem was shaken gently to remove the soil after-which it was weighed and the result recorded.

Dry weight: The soybean plant was sun dried for five days to remove all moisture before it was weighed.

Number of leaves: This was also obtained by counting the number of leaves on the plants per group.

Method of Data Analysis

Descriptive statistics such as the bar-graph mean and standard deviation was used to show the effect of the various detergents and soda soap on soybean plant.

RESULTS

Plate 1 to plate 5 indicate application of various concentrations of soda and three detergents (sunlight, ariel and omo) on the growth and survival of soybeans (*Glycine max*) in comparison with control plants in plate 1

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Plate 1: Picture of Soybeans (*Glycine max*) Before Treatment.

Plate 2: Soybeans (*Glycine max*) Treated with Soda at 0 %, 5 %, 10 %, 15 % and 20 % Concentration.

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Plate 3: Soybeans (*Glycin max*) Treated with Sunlight at 0 %, 5 %, 10 %, 15 % and 20 % Concentration

Plate 4: Soybeans (*Glycine max*) treated with Ariel at 0 %, 5 %, 10%, 15 %, and 20 % Concentration.

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Plate 5: Soybeans (*Glycine max*) treated with Omo at 0 %, 5 %, 10 %, 15 % and 20 % Concentrations.

Figure 1 indicate the mean values of soybeans in relation to plant heights, leaf numbers and leaf area, while figure 2 was used to determine the fresh and dry weights of all the treatments applied to the growth of soybeans in the field trials.

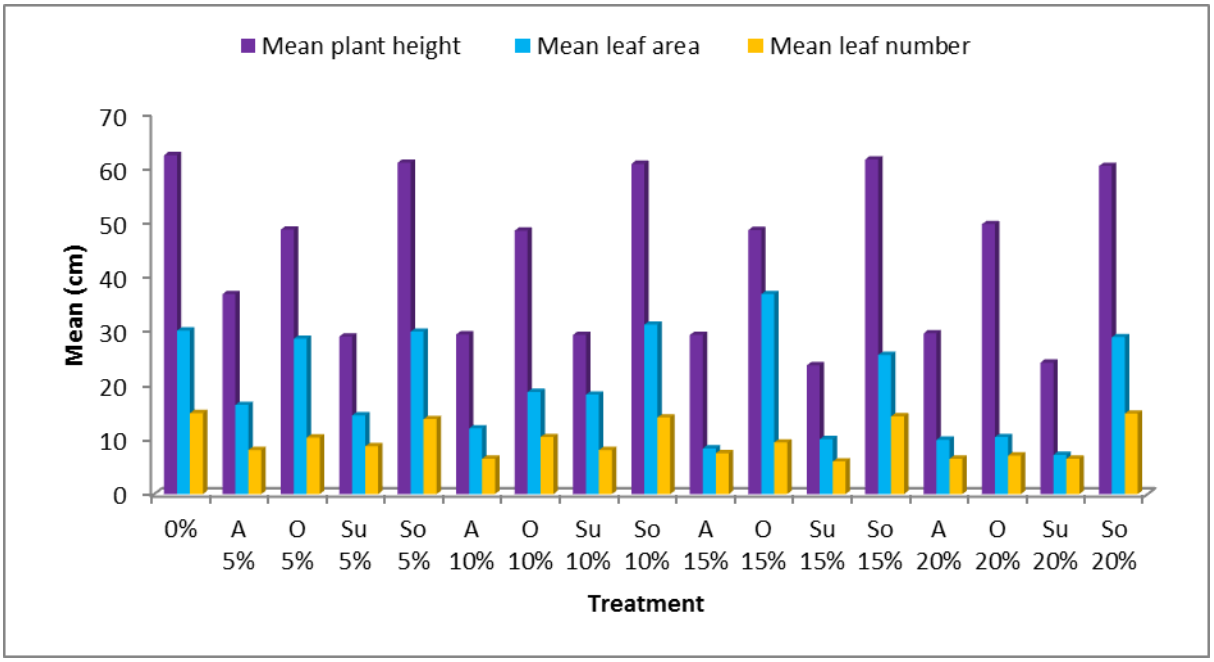

Figure 1: Mean value (cm) of Soybean (*Glycine max*)

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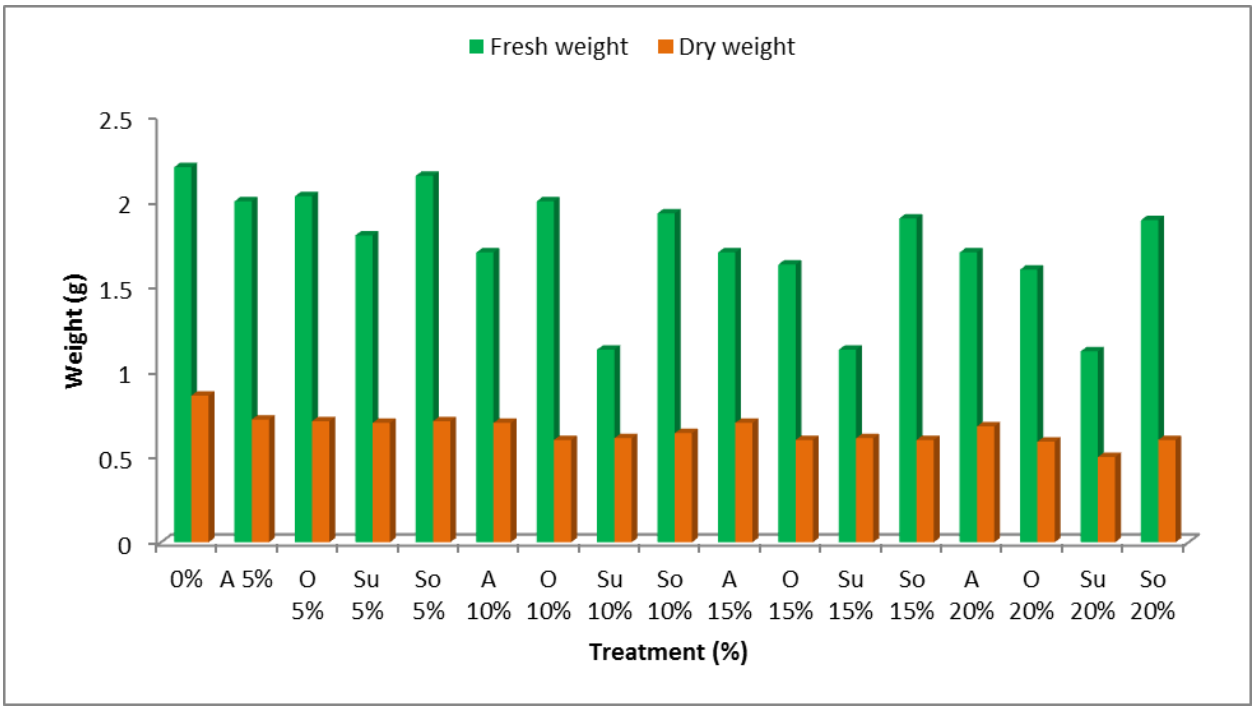

Figure 2: Fresh and dry weight of Soybean (*Glycine max*)

DISCUSSIONS

To compare the effect of the various detergents and soda on the growth of soybeans (*Glycine max*), the data obtained for these experiments were subjected to statistical analysis taking into consideration the mean and the standard deviation.

Figure one (1) above mean plant height, leaf and mean leaf number of Soy-bean (*Glycine max*) in centimeters (cm) were plotted against various treatments of detergents and local soap (caustic soda) with varying concentrations. Each bar has its own specific colour representing the various conditions measured.

As revealed by the graph, the mean plant height from the start at 0 % showed that there was no contaminant that inhibited growth. But after treatment at varied concentrations, the effect of the treatment was revealed on the plants at varied degrees. While heights of Soybean plants in control were increasing, that treated with Ariel (A); A5 %, A10 %, A15 % and A20 % were decreased with complete distortion of growth by total burning of plant even at the lowest concentration of 5 %. This implies that Ariel has growth inhibiting effect even at the lowest concentration when compared with control.

Comparing omo (O); O5 %, O10 %, O15 % and O20 % with control, indicated minimal inhibitory effect with stunt growth at O5 and O10 %, and attained more than 50 % inhibition at O15 % and complete inhibition at the highest concentrations of O20 %. Therefore, omo has negative inhibitory effect on plant height compared with control.

Also, comparing control with sunlight (Su) at Su5 %, Su10 %, Su15 % and Su20 %, mean plant height was inhibited at various concentrations. This was revealed by a decrease in plant

growth in all the concentrations applied. This finding shows that sunlight has a strong inhibiting effect on the growth of *Glycine max*.

Using control to compare the effect of soda at 5 %, 10 %, 15 % and 20 % concentration on soybean, it showed that the height of soybean grew in correspondence with the control across the various concentrations applied. This revealed a difference from the other treatments applied. While sunlight, ariel and omo has a negative inhibiting effect on *Glycine max*, Soda exhibited a promoter effect by promoting the growth of soybean in height.

As other treatment hindered the growth of the plant by decreasing its height, leaf number and area as well as plant fresh and dry weight, soda affected the plant positively by causing increase in the parameters measured. This is assumed to be as a result of the presence of potassium or sodium compounds present in soda which form part of the macro-element needed by plant for effective growth. This elements/compound has been found to be growth inducer and incorporated in fertilizers which are used for enhancing plant growth.

Comparing the effect of the various treatments on soybean, it was discovered that Ariel and Sunlight had the worse effect on the growth of soybean at various concentrations compared to omo of which its effect was manifested with concentration increase.

From figure one (1) also, mean leaf number of Soybean was plotted against various treatments at varying concentrations.

The graph shows that leaves formation at 0 % contaminant (control) was not affected and leaf formation was normal. This was also normal with the soybean treated with soda at varied concentrations of 5 %, 10 %, 15 % and 20 %. The leaf formation was normal and the plants increased in leaf number as the concentration of soda increased. This was different from the observation noticed from the plant treated with omo, whose effect on leaf number increased negatively with concentration increase. This shows that omo at 5 % concentration has little or no effect on leaf number as compared to omo at 20 % concentration which revealed the worse effect on the plant leaf number. The graph also revealed that plants treated with ariel and sunlight at the varied concentrations of 5 %, 10 %, 15 % and 20 % has negative effect on soybean mean leaf number. Their effects were indifferent with concentration increase. The inhibitory effect was worse on new leaf formation which makes the mean leaf number to drop/fall. The rate at which leaves fell from plants treated with ariel and sunlight at varied concentrations were faster, compared to that which occurred with plant treated with omo. It is important to note that this result was gotten by manual hand counting.

Figure one (1) also reveal mean leaf area of soy-bean (*Glycine max*) in (cm^3) plotted against various treatments of detergents and local soap (soda) with varying concentration

From the graph, it was revealed that the mean leaf area for control after treatment stood at normal, but with the soy-bean plant treated with ariel and sunlight, there was reduction in the leaf-size brought about by the reduction in the rate at which new cells are formed in the leaf thereby resulting in wilting and shrinking of the leaves. The result shows clearly that ariel and sunlight has the worse effect on leaf-area at varying concentrations compared to omo. With omo, the effect was revealed with concentration difference and was highly manifested in 15 % and 20 % concentrations.

Soda on the other hand has no negative effect on soy-bean leaf area, nor does it result in wilting and shrinkage of the leaves like ariel and sunlight. Soda led to increase in the plant leaf area.

From figure two (2), the mean fresh weight and dry weight (g) was plotted against the various treatments with varying concentrations.

Soybean fresh weight for control stood as 2.20 g and dry weight at 0.86 g. This loss of weight is assumed to be due to loss of water and moisture content brought about by drying up or wilting. Comparing fresh and dry weight of plant treated with soda 5 %, 10 %, 15 % and 20 %, there was a gradual drop in the fresh and dry weight of the plant with concentration increase. This may have resulted from the slow-down in metabolic rate at which new cells are formed therefore leading to a loss in weight i.e. fresh weight. But for dry weight, it fell below normal showing that treatments affected the dry weight.

Comparing fresh and dry weight of plant treated with ariel and omo at 5 %, 10 %, 15 % and 20 %, there was also a gradual drop in the fresh and dry weight of the plant with concentration increase. The effect of the treatment at 5 % has no difference on the fresh and dry weight as compared to the control but the effect on fresh and dry weight increased as the concentration increased. A sharp contrast was seen with the fresh and dry weight of plant treated with sunlight. The fresh weight recorded 1.80 g as compared to the control which recorded 2.20 g. This difference was also seen in the dry weight of 0.70 g as compared to the control which weighed 0.86 g. This result revealed that all the treatments applied had inhibitory effects on the fresh and dry weight of soybean. But a worse effect was seen in sunlight which has a stronger inhibiting effect on the fresh and dry weight of soybean plant as compared to the other treatments applied. This effect was worse with higher concentration of sunlight at 20 % with the fresh and dry weight of 1.12 g and 0.50 g respectively.

The aim of this research was to investigate the effects of different detergents such as omo, ariel, sunlight and soda on the growth of soybean (*Glycine max*). The result of the research showed that detergents have damaging effects on soy-bean growth but soda has a promoter effects on soybean.; The effect of detergent on soybean did not follow the level of varying concentration for some as did for omo. This result is in accordance with Gerardo (2010) which also discovered that groups of plants watered with common detergents depicted clear negative effects in their growth, health and density compared to the control. Contrary to the above findings, plants treated with varying concentration of soda had no negative effect on soy-bean but rather accelerated their growth in terms of mean plant height, mean leaf area and mean leaf number respectively. These findings are also supported by Gerardo (2010) findings on soap on which he says" plants watered with biodegradable detergent solutions, compared to the control, showed important benefits in height and size showed perfect health and accomplished the best density per square centimeter". This beneficial effect of this local soap can be attributed to the high potassium compound present in the soap.

Considering the effect of omo on soybean plant, the result revealed that the death of (*Glycine max*) was due to the increasing levels of detergent concentrations. This is in agreement with Pinto *et al*. (2010) that also discovered that higher concentration of detergent led to higher pH and EC of irrigation waters which in turn leads to negative effect on plant production and health.

CONCLUSION

This research revealed that *Glycine max* can tolerate low, moderate and higher level of Soda but any concentration of detergent will hinder its growth. It therefore becomes logical to conclude that due to the presence of surfactants in detergent any concentration of it inhibited or hindered the proper growth and development of soybean. Such inhibition or hindrance was seen in areas such as reduction in leaf number, reduction in plant height and reduced leaf area. Surprisingly, Soda which contains high level of potassium gotten from ash, aided soybean growth and development this is because potassium is a macro element needed for plant growth. Therefore, it was the potassium in soda that caused the rapid growth rate of soybean. These findings do not approve the use of soda as fertilizer for crops but advice on the use of potassium as an addictive of inorganic fertilizer to be adhered to. Also, proper care should be taken to prevent our crops from coming in contact with detergent solution.

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