

EFFECTS OF DETERGENTS AND LOCAL SOAP ON CAJANUS CAJAN

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Abstract

Young plants of pigeon pea, *Cajanus cajan*, were selected and subjected to different concentrations (5%, 10%, 15% and 20%) of detergents (ARIEL, BUNUX and OMO – denoted by the letters A, B and O) and local soap (SODA – denoted by the letter S). The results showed that as the concentration of the detergents increased from 15%-20%, growth parameters (plant height, leaf area, girth and leaf number) decreased progressively. Plants treated with local soap “Soda” at different concentrations (5%, 10%, 15% and 20%) had their growth parameters not affected as they grew well like the plants in control (water). Senescence was observed in plants treated with detergents leading to total mortality at 20% concentration. Total mortality was not observed in plants treated with different concentrations of local soap “Soda”.

Key words: Detergents, local soap “Soda”, mortality

INTRODUCTION

Helenius et al., (1979) defines detergent as Substances that when dissolves in water posses the ability to remove dirt form surfaces. Such as the human skin, textiles and other solids, such is termed a detergent.

Detergents can also be defined as amphiphathic molecules that self-associate and bind to hydrophobic surface. Their intrinsic property forming curved micelles in aqueous solution makes them useful for solubilizing planar biological membranes proteins by the formations of mixed micelles often without denaturing them. Although, they have proved invaluable tools for solubilizing integral membrane proteins.

It has become apparent that not all detergent are equally efficient at solubilizing membranes, and that membranes proteins and lipids are differentially extracted by individual detergents Garavito et al., (2001). These observations have provided support to the concept that, membrane are not homogenous and contains micro domains with distinct lipid and protein composition.

The effects of detergent on plants vary depending on how the plant is exposed to it first of all, if a plant is sprayed with detergent solution to cover all the leaves, the detergent which contains surfactant as a component has a lethal effect on the plant Gellini *et al.*, (1985). In general biological detergents are most commonly used to disrupt the bipolar lipid membrane of cells in order to first free on their solubilize membrane-bound proteins. Some detergents can also be used to solubilize recombinant protein, while others find their usage in the stabilization, crystallization, or denaturing of proteins. Additional applications include the extraction of DNA and RNA, the solubilization of specimens for diagnostic application, the lysis of cells, the preparation of liposomes, prevention of reagents and analyze precipitation from solution, and the prevention of non-specific binding in immunoassays Hjelmeland (1990). Detergents have the following components, surfactant, Abrasives, water softener, oxidizers, non-Surfactant, Enzymes and other ingredients among these entire components; surfactant has the most lethal effects on plant (vegetation). Gellini *et al.*, (1985).

The term "soap" refers to particular types of detergent in which the water-solubilized group is carboxylate and the positive ion is usually sodium or potassium. Soap is manufactured by an alkaline hydrolysis reaction called saponification.

MATERIALS AND METHOD

Healthy seeds of pigeon pea, *Cajanus cajan* were obtained from the different markets in Abraka, Delta State. The soil used was sieved with sand sieves (filter) to remove debris and to loosen the soil particles to enable easy percolation of water. The sieved soil was then weighed with weighing balance into nursery bags and each bag weighed 100g. The bags were replicated and three seeds were planted per bag. The plants were watered regularly for germination and stability. The detergents and soap employed are the commonest used domestically (Ariel, Bonux, Omo and Soda) by the people of Nigeria.

Different concentrations were made into 5%, 10%, 5% and 20% of the detergents and soap. Viability test was done to ascertain the viability of seeds for planting into polythene bags.

RESULTS

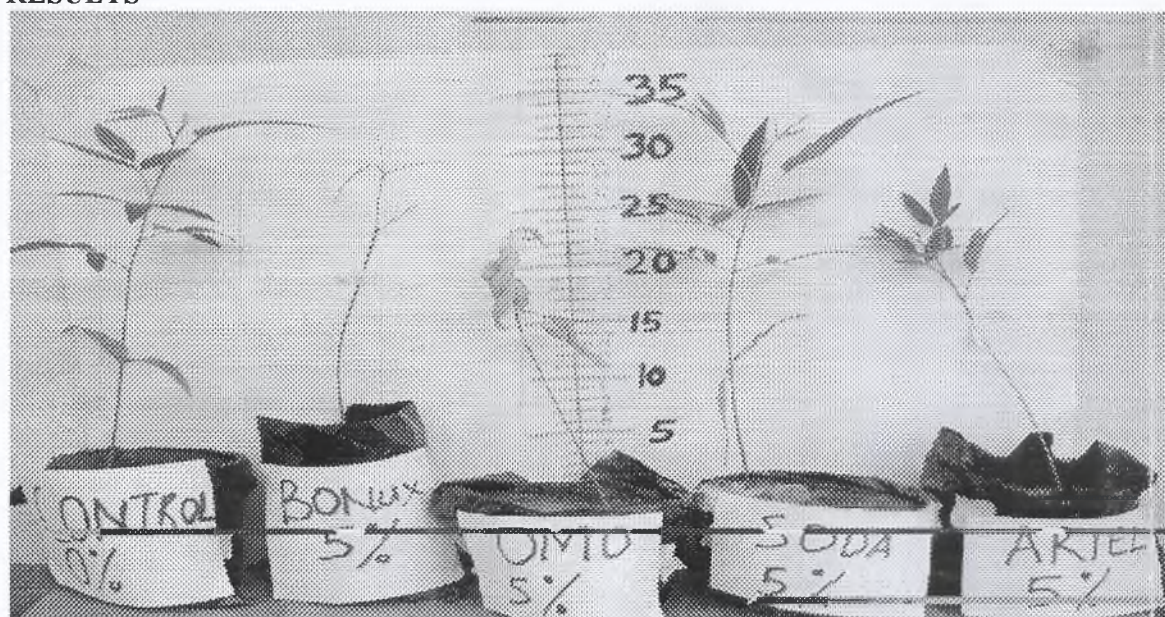


Plate 1 (colour online): Effects of 5% concentration of detergents and local soap on *Cajanus cajan* (pigeon pea) under 2 weeks of treatment

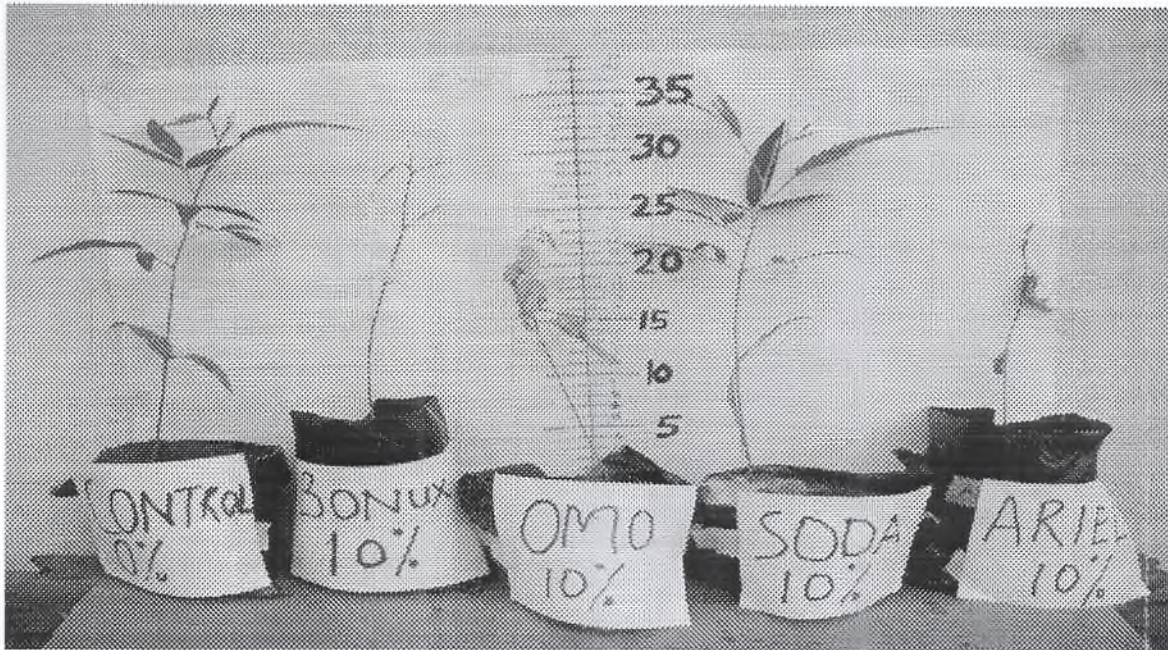


Plate2 (colour online): Effects of 10% concentration of detergents and local soap on *Cajanus cajan* (pigeon pea) under 2 weeks of treatment

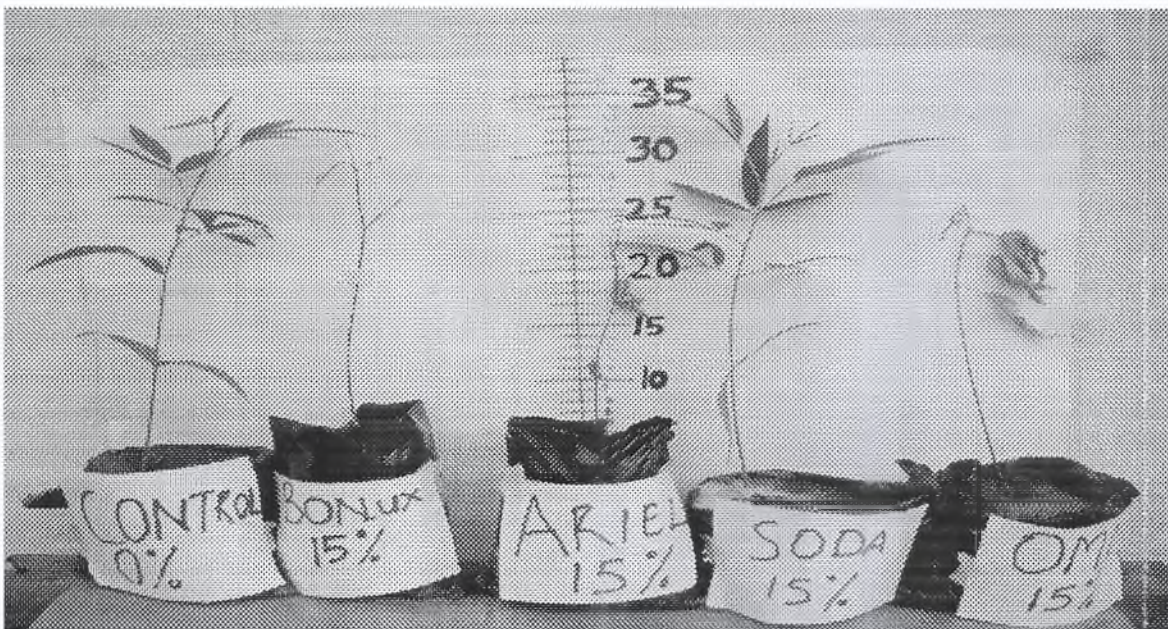


Plate3 (colour online): Effects of 15% concentration of detergents and local soap on *Cajanus cajan* (pigeon pea) under 2 weeks of treatment

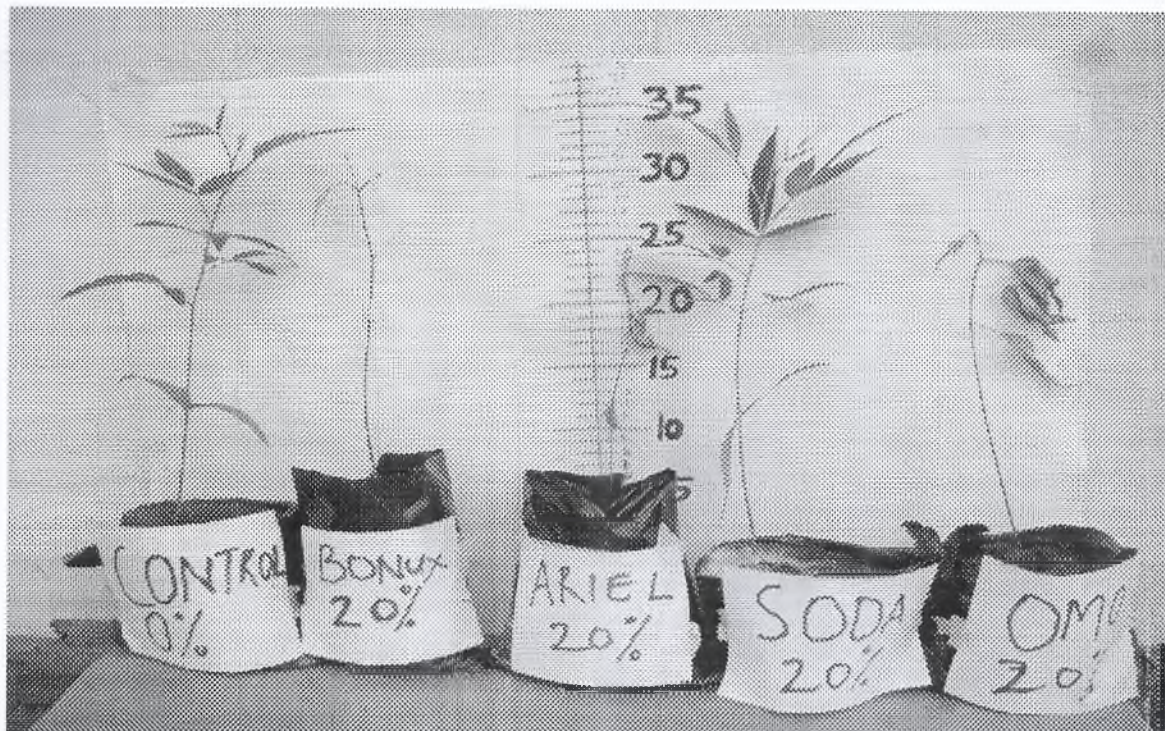


Plate4 (colour online): Effects of 20% concentration of detergents and local soap on *Cajanus cajan* (pigeon pea) under 2 weeks of treatment

In Plates 1-4, less than a week of treatment, at 5% concentration, plants treated with the three different detergents exhibited senescence which leads to mortality of the plants with exception to Ariel detergent. Plants treated with 5% concentration of local soap did not exhibit senescence and mortality (Plate 1). Total mortality occurred in all the plants treated with 10%-20% concentrations of the three detergents while plants treated with local soap at these concentrations were unaffected (Plates 2, 3 &4)

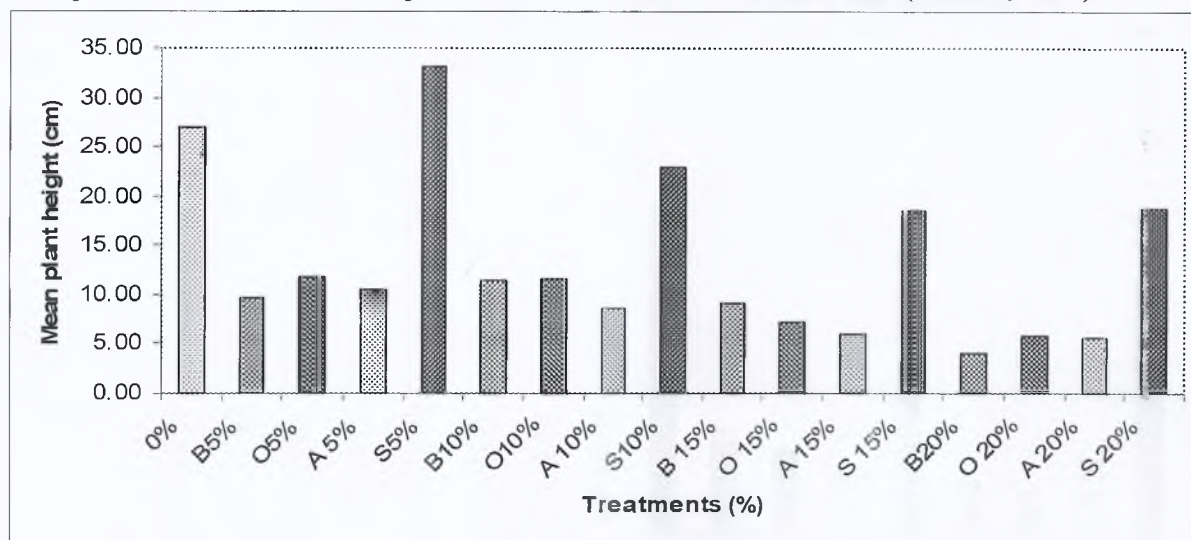


Fig 1 (colour online): Effects detergents and local soap on the Mean plant height of *Cajanus cajan* (pigeon pea) under 2 weeks of treatment.

As the concentrations increased, there was a progressive decrease in the mean plant height. The highest mean plant height was obtained in plants treated with 5% concentration of soda (Fig 1). The mean plant height of

plants treated with soda at different concentrations was significantly different ($P < 0.05$) from plants treated with the three different detergents' concentrations (Fig 1)

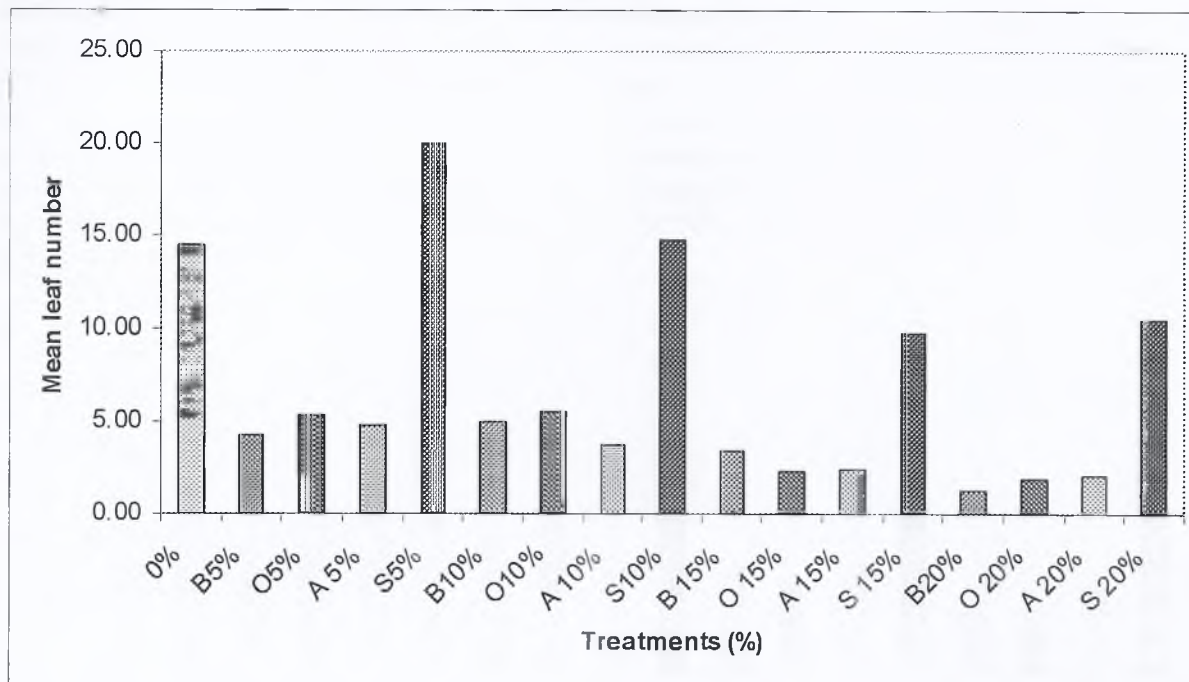


Fig 2 (colour online): Effects detergents and local soap on the mean leaf number of *Cajanus cajan* (pigeon pea) under 2 weeks of treatment.

There was no significant difference ($P > 0.05$) in the mean leaf number of plants treated with 5% concentration of the detergents (Fig 2). Increase in the concentration of both local soap and the detergents resulted in the decrease of the mean leaf number. The highest mean number was obtained in the plants treated with 5% concentration of local soap. It was observed that there was significant difference ($P < 0.05$) between the mean leaf number of plants treated with 5% concentration of local soap and those treated with 20% concentration of the local soap (Fig 2).

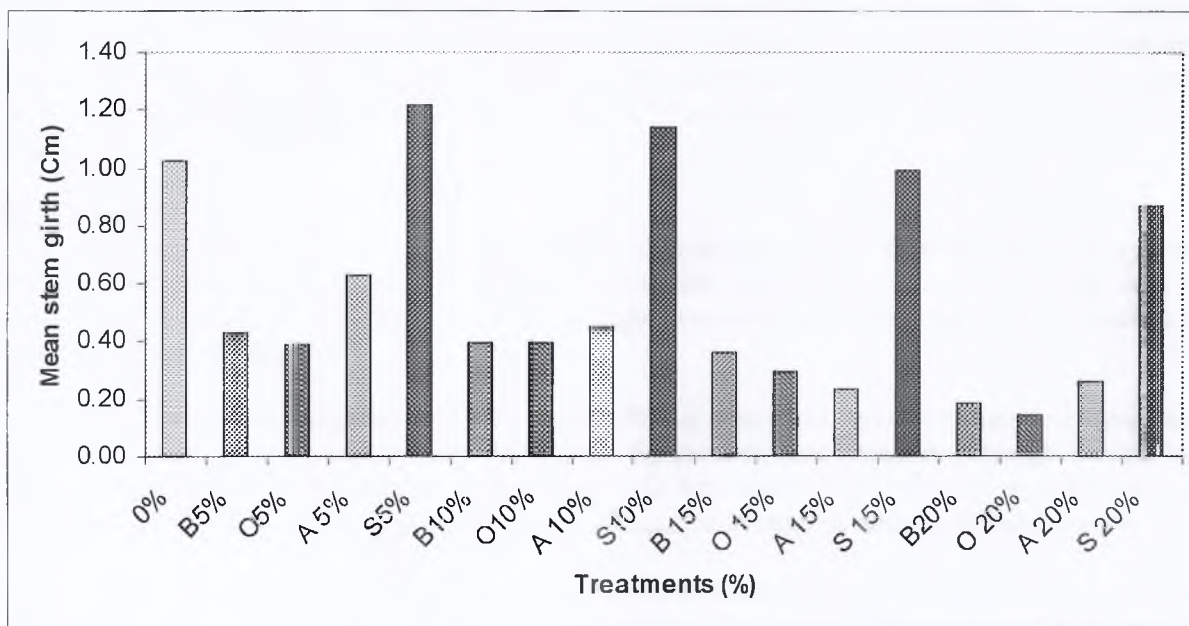


Fig 3 (colour online): Effects detergents and local soap on the mean stem girth(cm) of *Cajanus cajan* (pigeon pea) under 2 weeks of treatment.

As concentrations increased, there was a similar pattern of decrease in the mean girth of all the plants. There was no significant difference ($P > 0.05$) between the mean stem girth obtained in plants treated with 5% and 10% Bonux and Omo detergents. The highest mean stem girth was obtained in plants treated with 5% concentration of local soap. There was no significant difference ($P > 0.05$) in the mean stem girth between plants treated with 5% and 10% concentrations of local soap. The least value of mean stem girth was obtained in plants treated with 20% concentration of Omo detergent, and was found to be significantly different ($P < 0.05$) from the mean stem girth of plants treated with 5% concentration of local soap and control (Fig 3)

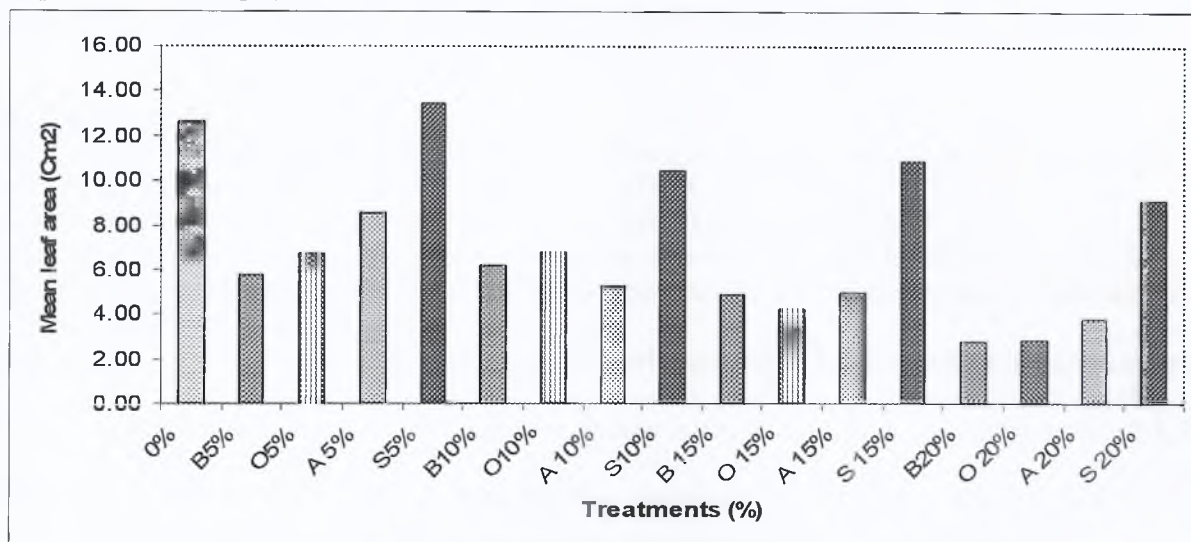


Fig 4 (colour online): Effects detergents and local soap on the mean leaf area (cm²) of *Cajanus cajan* (pigeon pea) under 2 weeks of treatment.

The highest value of mean leaf area was obtained in plants treated with 5% concentration of local soap while the least values of mean leaf area were obtained in plants treated with 20% concentration of Bunux and Omo detergents (Fig 4). There was significant difference ($P < 0.05$) between the mean leaf area of plants treated with 5% concentration of local soap and the plants treated with 20% concentration of Bunux and Omo detergents (Fig 4). There was significant difference ($P < 0.05$) between plants grown in control and those treated with 5%, 10%, 15% and 20% concentrations of the three different detergents (Fig 4).

DISCUSSION

It was observed that low concentration (5%) of local soap "Soda" favoured the growth parameters of plants used (Plates 1-4). This is in accordance with what Carl, (1998) reported that soap at a minute concentration acts as fertilizer to the plant while at higher concentration it then shift from its positive effects to harmful effects to the plant.

As low as 5% concentration of the three different detergents, growth parameters were hindered. The severity of the effects on plants also depends on the level of concentration, although it never had any positive effects on plants. This was earlier reported by Gellini, *et al.*, (1985) that excess detergent to plants has detrimental effects on the vegetation including alternation to stomata and epicuticular waxes.

The inhibitory effects that lead to total mortality in plants treated with detergents started from the least concentration (5%). The higher the concentration, the higher the adverse effects on growth parameters and the effects of detergent on plant are systemic because all parts of the plants are affected (

Figs 1-5), this concurs with the previous work by paoletti, *et al.*, (1989) that detergent causes direct injury such as alterations in photosynthesis, shrinking of the stem girth, leaf length, plant height, yellowing of leaves and finally the total mortality of the plants.

This agrees with the earlier report of Gellini *et al.*, (1985) that visible leaves injury has been observed in *Pinus* treated for one week with 100mg detergent. The severity of the detergents on the plants was so high that total mortality was recorded. Large quantities of surfactant which is a component of detergent can cause direct injury on plant such as alteration in photosynthesis inhibition of growth paoletti, *et al.*, (1989) transpiration, Smith (1941), induction of high ratio of chromosome aberration Bellani, *et al.*, (1991) and germ tube elongation, Feder (1981) and also root elongation and mitotic index. Contrary to the results obtained with detergents, local soap tends to act as growth promoter.

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