WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

The Effect of Sweet Potato Extract on the Germination and Growth of Cowpea (*Vigna Unguiculata* (L.) Walp)

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A B S T R A C T

This research was carried out at the Centre for Ecological Studies, Abuja Campus, University of Port Harcourt. This study was conducted to determine the effect of sweet potato water extract on the germination and growth of cowpea (Vigna unguiculata (L.) Walp). Twenty cowpea seeds were soaked in different concentrations of sweet potato water extract, namely 0%, 20%, 40% and 60% in a petri dish for 96 hours with 3 replications. The same concentrations of sweet potato water extract were applied on the cowpea plant at 1 week after planting in buckets of 10kg well-drained sandy loamy soil. The treatments were laid in a Completely Randomized Design (CRD). Examination of the plant height, number of leaves, fresh weight, dry weight and chlorophyll content of the plant were used to ascertain the effect of the sweet potato extract on the growth of the cowpea plant. The results obtained revealed that the different concentrations of sweet potato extract had no significant effect (p=0.05) on the germination of cowpea seeds as all the seeds sprouted at the same time. The cowpea plant applied with 0% concentration of potato extract treatment (control) had the highest growth and yield when compared with other treatments. The potato extract treatment of 20% concentration had the least growth and yield. The results obtained revealed that sweet potato extract has both inhibitory and stimulatory effects on the cowpea plant.

Keywords: Growth, sweet potato water extract, cowpea, treatments

1. INTRODUCTION

Vigna unguiculata commonly known as cowpea, crowder-pea, southern pea, black-eyed pea, is an annual herbaceous legume from the genus *Vigna*. Cowpeas are small, kidney-shaped beans in the legume family *Fabaceae*. (Small, 2009). The name was most likely acquired due to their use as a fodder crop for cows (Timko *et al*, 2007). There is a wide range in leaf size and shape, making this an important feature for classifying and distinguishing cowpea varieties. (Pottorff *et al*, 2012). Cowpea is a warm season crop and thrives in hot, moist conditions (Hall, 2001). The crop is also grown in the derived savannah and rain forest belt of Nigeria.

Cowpeas are tolerant to hardy conditions including high temperature, drought and poor soil which means they can be grown successfully in many areas than most of the other legumes (Blackhurst and Miller, 1980).

Cowpea is an important grain legume in Africa. Cowpea has many beneficial uses as animal feed, human consumption, and income generation (IITA, 2009). Cowpeas are grown mostly for their edible beans, although the leaves, green seeds and pods can also be consumed (Ehlers and Hall, 1997). The seeds can be consumed fresh along with the pods before the dried seeds are harvested, or the dried seeds are cooked, usually by boiling to make them edible.

Cowpea seeds are an important source of protein in the diet of many rural and urban Nigerians. Cowpeas can be prepared in stews, soups, purees, casseroles and curries or processed into a paste or flour. In Nigeria, a common snack is bean cake popularly called 'moin-moin', where the cowpeas are mashed into a paste, mixed with spices and steamed in banana leaves or small plastic bowls. The fresh immature pods are boiled with the young shoot and served with yam and palm oil (Uguru, 1996). They also use the cowpea paste as a supplement in infant formula when weaning babies off milk (Oyeleke *et al*, 1985).

Ipomoea batatas (L.) Lim (sweet potato) is a sweet, starchy, dicotyledonous, root vegetable that belongs to the family *Convolvulaceae* (Pursglove, 1968; Woolfe, 1992).

Potato extracts were also inhibitory to yellow nutsedge (*Cyperus esculentus* L.) germination and Alfalfa (*Medicago sativa*), (Harrison and Peterson, 1986). Walker & Jenkins (1986) found that sweet potato whole plant residues in field soil were inhibitory to cowpea [*Vigna unguiculata* (L.) Walp] and sweet potato vine cuttings. Decaying sweet potato residues reduced the uptake of Ca, Mg and S by sweet potato plants, thus inhibiting their growth (Walker *et al*, 1989).

This experiment was carried out to investigate the effects of potato extract on the germination and growth of cowpea [*Vigna unguiculata* (L.) Walp].

2. MATERIALS AND METHODS

2.1 Description of Experimental Site

The experiment were conducted at the Centre for Ecological Studies (The Green House), beside Ofrima Complex, Abuja campus, University of Port Harcourt, Rivers state, Nigeria. It was located on latitude 4° 53' 14" N through 4° 54' 42" N and longitude 6° 54' 00" E through 6° 55' 50" E.

2.2 Source of Planting Material

Matured cowpea seeds were sourced from the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. Perforated buckets were used for planting the seeds. A total of twenty buckets were used to carry out the experiment. Each bucket was filled with 10kg of top soil. The soil sample used was top soil sourced from the university premises. Soil samples were collected and analyzed for presence of Nitrogen, Phosphorus, Potassium, and Organic matter and soil pH. No manure were added to the soil.

2.3. Viability Test

The seeds were tested to know their germination percentage using the germination test method. The seeds were germinated in petri dish lined with filter paper at the rate of fifteen seeds per petri dish. The seeds were moistened regularly as deem appropriate with water. Three replications were carried out for each treatment at different hours ranging from 0 to 96 hours. Germination was scored when the radicle protrudes from the seed coat. Germination percentage was then calculated.

2.4 Planting of Seeds

The seeds were planted directly into buckets. Twenty seeds were planted per bucket and after germination occurred the plants were thinned to ten plants per bucket.

2.5. Application of Potato extract Treatment

The stock potato extract were produced by boiling the peeled potato in purified water sourced from the University of Port-Harcourt bottling plant for 20 minutes. The peeled potato were weighed in grams of 1000g, 2000g and 3000g and blended with 5000ml of purified water to prepare the concentrations of 20% potato water (treatment 2), 40% potato water (treatment 3), 60% potato water (treatment 4) and in control (treatment 1) only the purified water were used.

The application of treatment solutions began one week after sowing the seeds. Parameters were measured before the treatment started. 500mL of each concentration of the solution were applied carefully to the respective treatment bucket every three (3) days.

2.6 Cultural Practices

Weeding were done by hand picking in the buckets when necessary and hoes were used to weed the field around the buckets. Pests were also controlled by hand picking.

2.7 PARAMETERS UNDER STUDY

The measurement of parameters were carried out every two weeks for eight weeks following the application of the potato extract. The parameters measured were:

1. Plant height
2. Number of leaves
3. Fresh weight
4. Dry weight
5. Chlorophyll content

2.8 Statistical analysis

The data collected for each parameter were subjected to one-way Analysis of Variance (One - way ANOVA).

3. RESULTS AND DISCUSSION

The result of the study of the effect of potato extract on the plant height, number of leaves, fresh weight, dry weight and chlorophyll content of *V. unguiculata* over a period of 12 weeks were presented. The potato extract were applied a week after planting. The treatments used were fresh sweet potato extract of different concentrations with treatment 1 (T_1, control), treatment 2 (T_2), treatment 3 (T_3) and treatment 4 (T_4) containing 0% ,20%, 40% and 60% sweet potato extract respectively.

3.1 SOIL ANALYSIS

The physicochemical properties of the soil used for the experiment are presented in table 3.1. The results showed that the soil used were slightly acidic (5.58), high in organic matter (4.0) and low in total nitrogen (0.35). Available phosphorus and potassium were also high.

Table 1: The physicochemical properties of the soil

Soil properties	Values
pH	5.58mg/kg
Phosphorus	5.74mg/kg
Nitrogen	0.35%
Organic matter	4.0%
Potassium	1.20mg/kg

3.2. Germination Percentage of Seeds

The results of the cowpea (*Vigna unguiculata*) seeds soaked in different concentrations of sweet potato extract gave 75% germination each after 96 hours of soaking. There were no significant difference (P=0.05) in the germination between the different concentrations.

Table 2: Germination Percentage of Seeds

	Replicate 1	Replicate 2	Replicate 3
Total number of seeds planted (N)	20	20	20
Total number of seeds that germinated (n)	15	15	15
Germination percentage (%): n/N × 100	75	75	75

Keys:

N- Total number of seeds planted

n - Total number of seeds that germinated

3.3 PLANT HEIGHT

There were no significant difference (p=0.05) for the treatments. The highest values were recorded at T_1 with a mean height of 23.32± 0.068cm, T_4 with a mean height of 23.04±0.182cm, T_3 with a mean height of 18.38±0.230cm and T_2 with a mean height of 16.94±0.033.

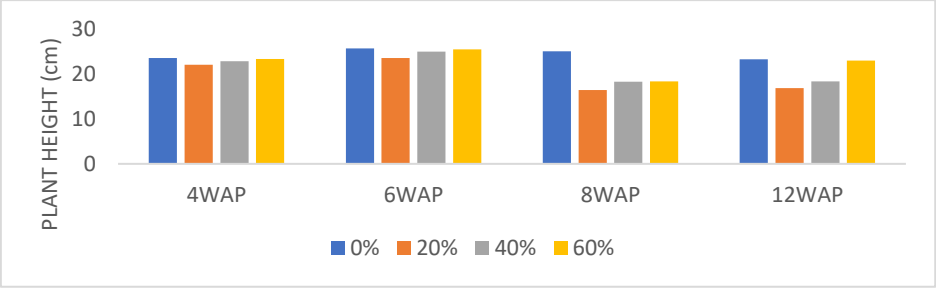

Figure 1: Effect of Different Concentrations of Potato extract on Plant Height

WAP- Weeks after Planting

3.4 NUMBER OF LEAVES

At 12weeks after planting, the highest number of leaves were recorded at T_1 with a mean number of leaves of 17.6±0.153cm, T_2 with a mean number of leaves at 11.96±0.056cm, treatment 3 with a mean number of leaves at 11.88±0.145cm and treatment 4 with a mean number of leaves at 10.46±0.078cm.

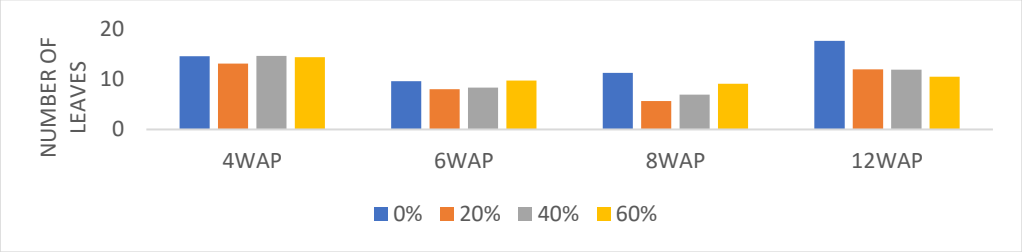

Figure 2: Effect of Different Concentrations of potato water on Number of Leaves

WAP- Weeks after Planting

3.5. FRESH WEIGHT

At 12 weeks after planting, the highest fresh weight were recorded at treatment 1 with a mean fresh weight at 6.28±0.09g, treatment 3 with a mean fresh weight at 4.42±0.052g, treatment 4 with a mean fresh weight at 4.31±0.047g and treatment 2 with a mean fresh weight at 3.39±0.040g.

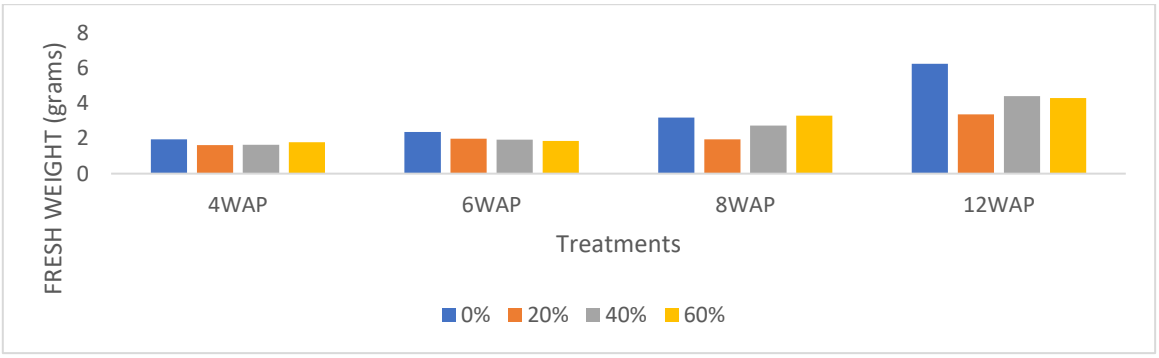

Figure 3: Effect of Different Concentrations of Potato water on Fresh Weight

WAP- Weeks after Planting

3.6 DRY WEIGHT

At 12 weeks after planting, the highest dry weight were recorded at treatment 1 with a mean dry weight at 1.43±0.021g, treatment 4 with a mean dry weight at 1.19cm±0.009g, treatment 2 with a mean dry weight at 0.97±0.005g and treatment 3 with a mean dry weight at 0.58±0.008g.

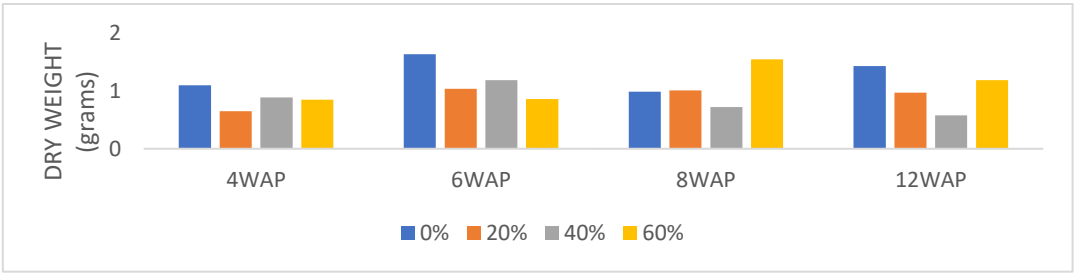

Figure 4: Effect of Different Concentrations of Potato water on Dry Weight

WAP – Weeks after Planting

4. DISCUSSION

The study investigated the effects of sweet potato extract on the germination and growth of *Vigna unguiculata*. This research also highlighted that different concentrations of sweet potato extract applied to the cowpea plant had varied effect on the plant.

The results of the different treatments using varied concentrations of sweet potato extract, namely, 0% sweet potato extract (treatment 1; control), 20% sweet potato extract (treatment 2), 40% sweet potato extract (treatment 3) and 60% sweet potato extract (treatment 4) indicated that treatment 1 (control) enhanced the growth of the cowpea plant when compared to other treatments. There were no significant difference (p=0.05) in the height of the treatments. Fluctuations were observed in the plant height in progressive weeks. This could be attributed to the inhibitory effect of sweet potato extract on the cowpea plant. This supports the previous findings that sweet potato plant may be very competitive with certain plant species including weeds (Villa-mayor and Perez, 1983) and cultivated crops but not particularly competitive with others (Peterson and Harrison, 1991). However, T_2 was more susceptible to increased pest attack than the other treatments. This may have contributed to the slight inhibition of growth of the cowpea plant height in T_2 when compared to T_3 and T_4 .

The number of leaves increased with the age of the cowpea plant till maturity but due to consistent pest attack and chlorotic symptoms on the plants at 8WAP, all the treatments particularly treatment 3 and treatment 4 suffered some deaths. The chlorotic symptoms may be as a result of disease infestation spread by pests.

The cowpea plant treated with 0% potato extract (treatment 1; control) accumulated significantly more fresh weight than others treated with 20% (treatment 2), 40% (treatment 3) and 60% (treatment 4) concentrations of potato extract. However, the difference in the fresh weight of treatment 2, treatment 3 and treatment 4 were not significant (p=0.05). Differences in dry weight of cowpea plant treated with treatment 1, 2, 3 and 4 were negligible.

5. CONCLUSION

The result obtained from this study indicated that application of sweet potato extract were both inhibitory and stimulatory to the growth and yield of the cowpea plant at different concentrations.

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