

**THE EFFECTS OF SALT STRESS ON THE GERMNATION OF
COWPEA (*Vigna unguiculata* (L.) WALP)**



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DEPARTMENT OF PLANT BIOLOGY AND BIOTECHNOLOGY

FACULTY OF LIFE SCIENCES

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BENIN CITY

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**A PROJECT REPORT SUNMITTED TO THE DEPARTMENT OF
PLANT BIOLOGY AND BIOTECHNOLOGY, IN THE FACULTY OF
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This is to certify that this work was carried out by **Itohan Mercy OSAMWONYI (Miss)** of the Department of Plant Biology and Biotechnology, in the Faculty of Life Sciences in the University of Benin, Benin City.

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SUPERVISOR

DATE

PROF. B. IKHAJIAGBE

HEAD OF DEPARTMENT

DATE

EXTERNAL EXAMINER

DATE

2.3.2 Seed Preparation

The cowpea seeds were first dipped in water for some seconds to determine the seed viability. For each replication, ten seeds were placed in each sterile Petri dish lined with a layer of Whatman No. 1 filter paper. Each Petri dish was moistened with 10 ml of the respective NaCl solution for the control. Germination was monitored daily for six days, with seeds considered germinated when the radicle protruded at least 2 mm (ISTA, 2019).

2.3.3 Sowing of Seeds

The experiment was laid out in a completely randomized design with five treatments and three replications. 10 seeds were sown in each black nylon bag which contained soil gotten from a farm site in blocks of flat inside the school premises.

The treatments consisted of five different concentrations of NaCl solution:

- **T0:** 0 ppm (Control)
- **T20:** 20 ppm
- **T40:** 40 ppm
- **T60:** 60 ppm
- **T80:** 80 ppm

These concentrations were selected to reflect low, moderate and high salinity levels that seeds might encounter in saline soils (Munns and Tester, 2008). Each treatment was replicated three times, making a total of 15 experimental units.

2.3.4 Germination Procedure

The cowpea seed were first dipped in water for some seconds to determine the seed viability. For each replication, ten 10 seeds were planted in each nylon bag at a depth of 0.5cm. The nylon bags were initially filled with soil gotten from blocks of flat within the school premises. The bag of soil was then filled with distilled water and the water was allowed to settle for 10 minutes before planting. The NaCl solution was added after planting. Germination was monitored twice a week for four weeks, with seeds considered germinated when the radicle protruded at least 2 mm (ISTA, 2019).

2.4 DATA COLLECTION

2.4.1 Germination

Germination started days after sowing, it was monitored and recorded daily for 6 days after planting.

Germination Percentage: Germination percentage is the measure of seeds viability. It is represented mathematically as:

$$GP = \frac{\text{number of seed germinated}}{\text{number of seed sown}} \times 100$$

2.4.2 Plumule Length and Radicle Length

On the 6th DAS, ten normal seedlings from each treatment were randomly selected. The length of the plumule (shoot) and radicle (root) was measured using a standard ruler.

2.4.3 Leaf Area

The leaf area was calculated by taking the measurement of the length and breadth of the leaf and then divided by 0.5.

2.4.4 Plant Height

The height of the plant was measured from the soil surface to the plant tip using a ruler. It was measured in centimetres (cm) and recorded three weeks after planting.

2.4.5 Stem Girth/Circumference

The stem girth was measured using a thread, marker and a ruler. It was measured in centimetres (cm) and recorded three weeks after planting.

2.4.6 Fresh Weight

The fresh weight was measured by harvesting the plant, shaking off the surface moisture, placing it on a digital weighing balance and recording it.

2.4.7 Dry Weight

The dry weight was measured by placing the plant in an oven at around 65-80 °C for 24 hours. It was then cooled before it was weighed using a digital balance and the weight was recorded.

CHAPTER THREE

RESULTS

The results of the study on the effects of salt stress on the germination of *Vigna unguiculata* (cowpea) are presented in Figures and Tables. The parameters studied were germination percentage, plumule length, radicle length, leaf area, stem girth, plant height, fresh and dry weights at varying salt concentrations and days after sowing (DAS). The values represent mean $\pm$ standard deviation.

Figure 3.1 shows the germination percentage of *Vigna unguiculata* seeds grown in different salt concentrations. Germination was observed to vary with salt levels and days after sowing. Generally, germination percentage was unstable as the concentration of salt increased. The 20 ppm was between 43.33% and 50.00% while the 40 ppm was between 40.00% and 46.67% and these treatments were recorded as the highest germination rates at early stages (1–2 DAS), while seeds exposed to 60 ppm which was between 23.33% and 50.00% showed the lowest germination rate throughout the period.

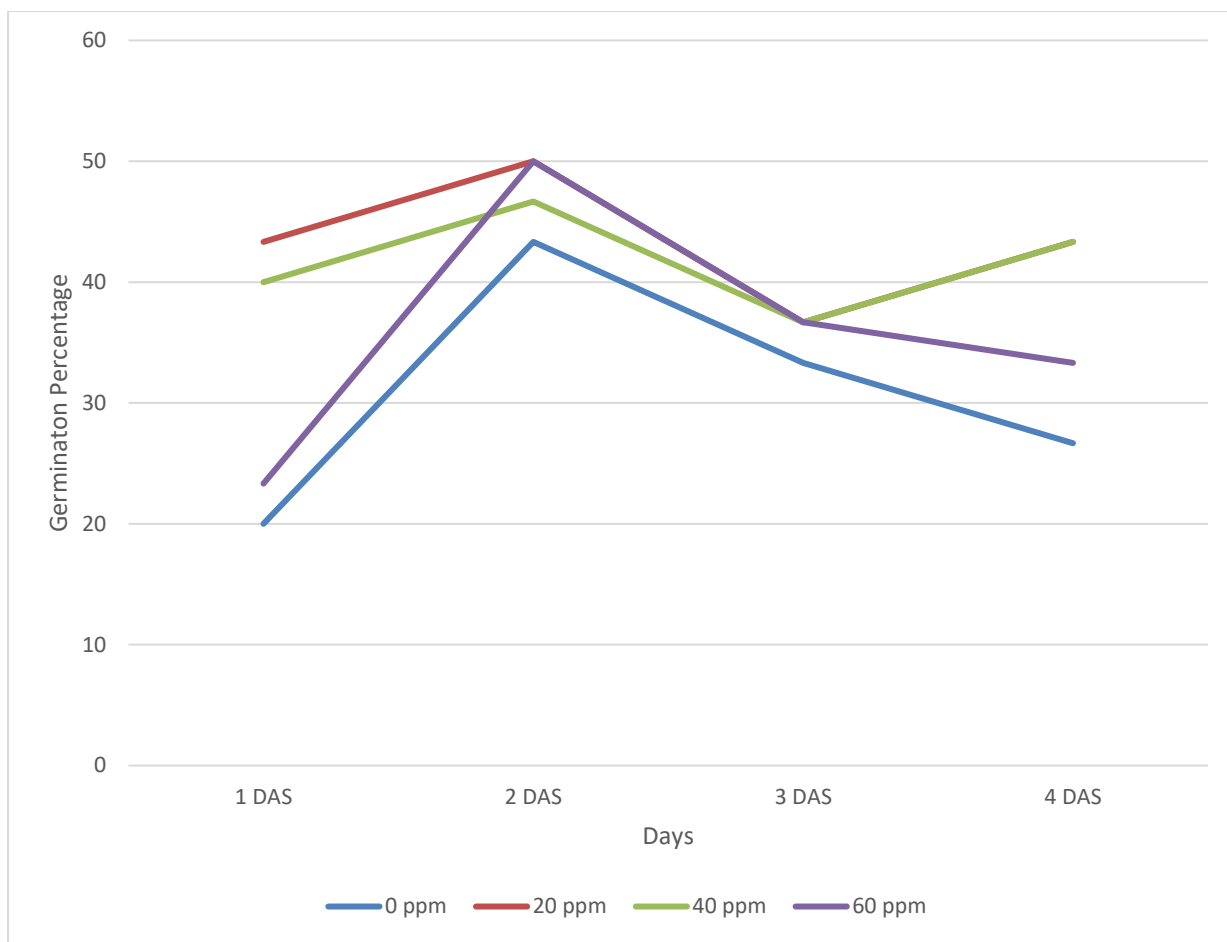


Figure 3.1: Germination Percentage (%) of *Vigna unguiculata* after exposure to salt stress.

1 DAS – 1 Day After Sowing

2 DAS – 2 Day After Sowing

3 DAS – 3 Day After Sowing

4 DAS – 4 Day After Sowing

APPENDICES

Germination Percentage (%) of *Vigna unguiculata* After Exposure to Salt Stress.

Treatment	1DAP	2DAP	3DAP	4DAP
0ppm	20.00 ± 0.20	43.33 ± 0.15	33.33 ± 0.23	26.67 ± 0.31
20ppm	43.33 ± 0.12	50.00 ± 0.20	36.67 ± 0.12	43.33 ± 0.12
40ppm	40.00 ± 0.26	46.67 ± 0.21	36.67 ± 0.31	43.33 ± 0.35
60ppm	23.33 ± 0.15	50.00 ± 0.00	36.67 ± 0.15	33.33 ± 0.15

Values = Mean ± S.D. DAP = Days After Planting.

Leaf Area of *Vigna unguiculata* After Exposure to Salt Stress.

Treatment	7 DAP	14 DAP	21 DAP	28 DAP
0ppm	0.00 ± 0.00	2.80 ± 4.85	13.60 ± 23.56	23.50 ± 40.70
20ppm	0.00 ± 0.00	4.37 ± 7.57	12.97 ± 11.24	29.38 ± 31.82
40ppm	10.97 ± 12.45	20.72 ± 21.45	27.11 ± 26.31	39.16 ± 33.92
60ppm	5.07 ± 7.19	20.33 ± 19.60	38.94 ± 25.70	89.68 ± 78.95
80ppm	6.47 ± 3.29	22.62 ± 5.70	40.73 ± 39.23	67.55 ± 60.47

Values = Mean ± S.D. DAP = Days After Planting.

Plumule Length of *Vigna unguiculata* After Exposure to Salt Stress.

Treatment	1DAP	2DAP	3DAP
0ppm	0.00 ± 0.00	1.33 ± 2.31	2.00 ± 3.47
20ppm	0.00 ± 0.00	4.00 ± 1.00	5.00 ± 1.00
40ppm	0.00 ± 0.00	3.67 ± 0.58	4.33 ± 1.53
60ppm	0.00 ± 0.00	1.67 ± 2.08	3.67 ± 0.55

Values = Mean ± S.D. DAP = Days After Planting.

Radicle Length of *Vigna unguiculata* After Exposure to Salt Stress.

Treatment	1DAP	2DAP	3DAP
0ppm	0.33 ± 0.58	2.00 ± 1.00	1.00 ± 1.73
20ppm	1.67 ± 0.58	4.33 ± 1.53	6.33 ± 3.21
40ppm	1.67 ± 0.58	4.33 ± 1.53	6.00 ± 2.65
60ppm	1.00 ± 1.73	2.00 ± 2.65	3.67 ± 4.04

Values = Mean ± S.D. DAP = Days After Planting.

Fresh Weight of *Vigna unguiculata* After Exposure to Salt Stress.

Treatment	4 WAP
0ppm	1.63 ± 2.83
20ppm	5.50 ± 5.36
40ppm	9.13 ± 8.27
60ppm	37.20 ± 41.71
80ppm	37.27 ± 27.60

Values = Mean ± S.D. WAP = Weeks After Planting.

Dry Weight of *Vigna unguiculata* After Exposure to Salt Stress.

Treatment	4 WAP
0ppm	0.30 ± 0.52
20ppm	1.77 ± 1.60
40ppm	1.87 ± 1.96
60ppm	14.60 ± 16.90
80ppm	12.03 ± 10.12

Values = Mean ± S.D. WAP = Weeks After Planting.

Leaf Height of *Vigna unguiculata* After Exposure to Salt Stress.

Treatment	21DAP	24DAP	28DAP	31DAP
0ppm	1.90 ± 3.30	2.00 ± 3.46	2.07 ± 3.58	2.13 ± 3.70
20ppm	2.33 ± 2.25	2.53 ± 2.37	2.87 ± 2.61	3.07 ± 2.75
40ppm	3.87 ± 3.35	4.17 ± 3.62	4.43 ± 3.87	4.77 ± 4.20
60ppm	4.73 ± 1.89	4.47 ± 3.87	5.07 ± 4.39	5.67 ± 4.91
80ppm	3.17 ± 2.75	3.63 ± 3.17	4.13 ± 3.61	4.40 ± 3.86

Values = Mean ± S.D. DAP = Days After Planting.