EFFECTS OF SALINITY ON SEED GERMINATION AND PRIMARY ROOT ELONGATION IN GROUNDNUT CULTIVARS.

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Department:
Rural Development & Agrarian Reform
PROVINCE OF THE EASTERN CAPE

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Crop Background

- Originates from South America, now distributed to countries with tropical and warm temperate climates.
- Erect growth form or a runner depending on subspecies.
- It forms part of legume group and comprises of 1-4 Kernels.
- Spike inflorescence with bright yellow colours.
- Source of vitamins, proteins and lipids.
- Groundnuts also serve industrial uses and animal feed purposes.

Crop Background

Table 1:Botanical classification of groundnut.

Kingdom	**Plantae**
Division	Tracheophyta
Subdivision	Spermatophytina
Class	Magnoliopsida
Order	Fabales
Family	Fabaceae
Genus	*Arachis*
Species	*Arachis hypogaea*

Salinity Definition

- Salinity is the measure of amount of solutes that are dissolved in a solvent, for example dissolution of NaCl in water.
- The salts that commonly cause salinity in soils are chlorides, sulphates and carbonates of sodium, magnesium and calcium.
- Sulphate salinity is the most detrimental type of salt stress.
- One of the major salts that induce salinity is sodium chloride (NaCl).
- The soil (A and B horizon) is also a source of salinity due to weathering of rocks.

Germination and Primary root elongation

- Germination is the conversion of food reserves to soluble forms that can be used by a developing embryo through enzymatic action.
- Embryo develops into a plumule and radicle.
- Primary root elongation is the development of radicle in length.
- Primary root is a fundamental part that absorbs nutrients and offers mechanical backing for shoot growth.

Problem Statement

- Groundnut contains high protein content and other important nutrients.
- Salinity is one of limiting factors in crop production, in which groundnut is not an exception.
- High soil salinity reduces seed germination and primary root elongation.
- These necessitate the search for crops with salinity tolerance.
- There is little information on salinity effects on seed germination and primary root elongation of various groundnut cultivars.

Research Questions

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- To address the problem, the following research questions need to be answer;
- Does salinity affects germination of groundnut seed?
- Does salinity affects primary root elongation?
- Does the effect of salinity vary in different groundnut cultivars?

Materials and Methods

- Dishes (18 litres), polystyrene sheets, four groundnut cultivars, nutrient solution, measuring ruler, sodium chloride salt, aeration tube, aeration pump and deionised water.
- A split plot design was used with two sets of treatments which were NaCl concentrations and four groundnut cultivars (‘Zim’, ‘Isinghinghi’, ‘99529’, and ‘Inkanyezi’).
- Polystyrene sheets which were cut in a rectangular shape of an area of 15 cm x 3 cm, five seeds were imbedded in each.
- The seeds were suspended on floating polystyrene sheets.

Materials and Methods- Solution Preparation

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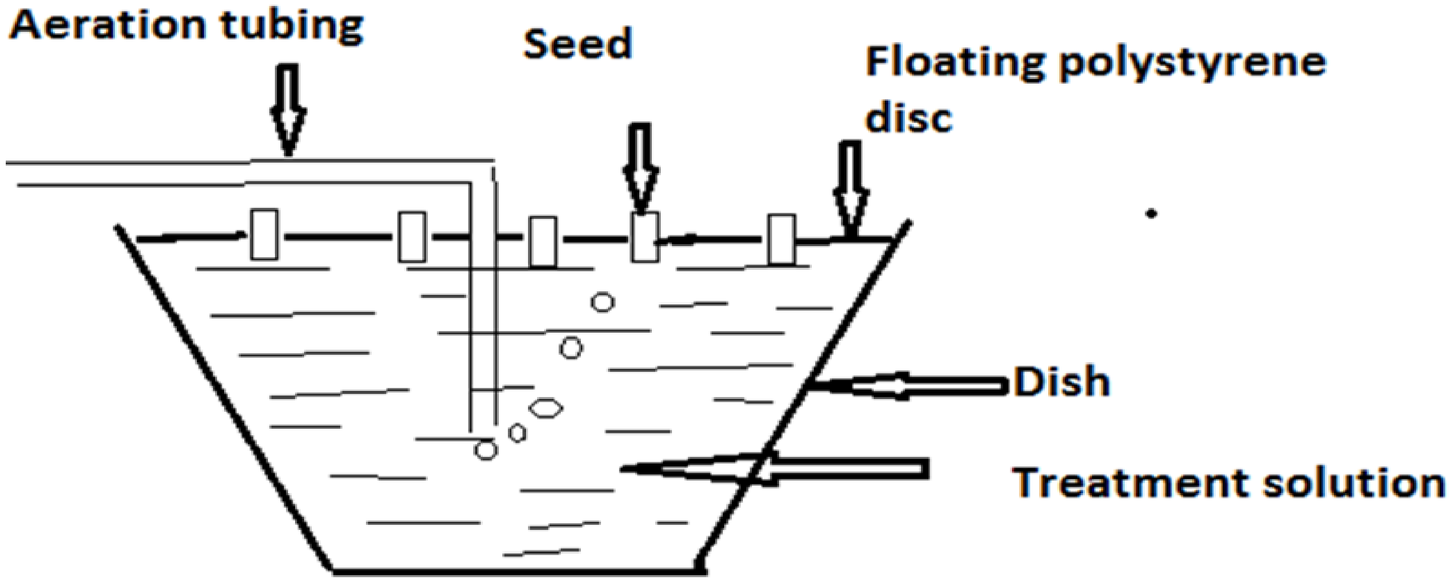
- Table 2: Amounts of sodium chloride dissolved in 18 L of distilled water to make different target concentrations.

Target NaCl concentration (M)	Amount of NaCl added to 18 L of water (g)
0	0
0.025	26.30
0.05	52.60
0.15	157.79
0.20	210.38

Materials and Methods-Design and Procedure

Study area description- controlled conditions, 26-28 degrees Celsius, Department of botany, University of Zululand KwaDlangezwa campus



- Figure 1: Dish with floating polystyrene sheets in which seeds were embedded with point of radicle emergence facing downward and in contact with solution

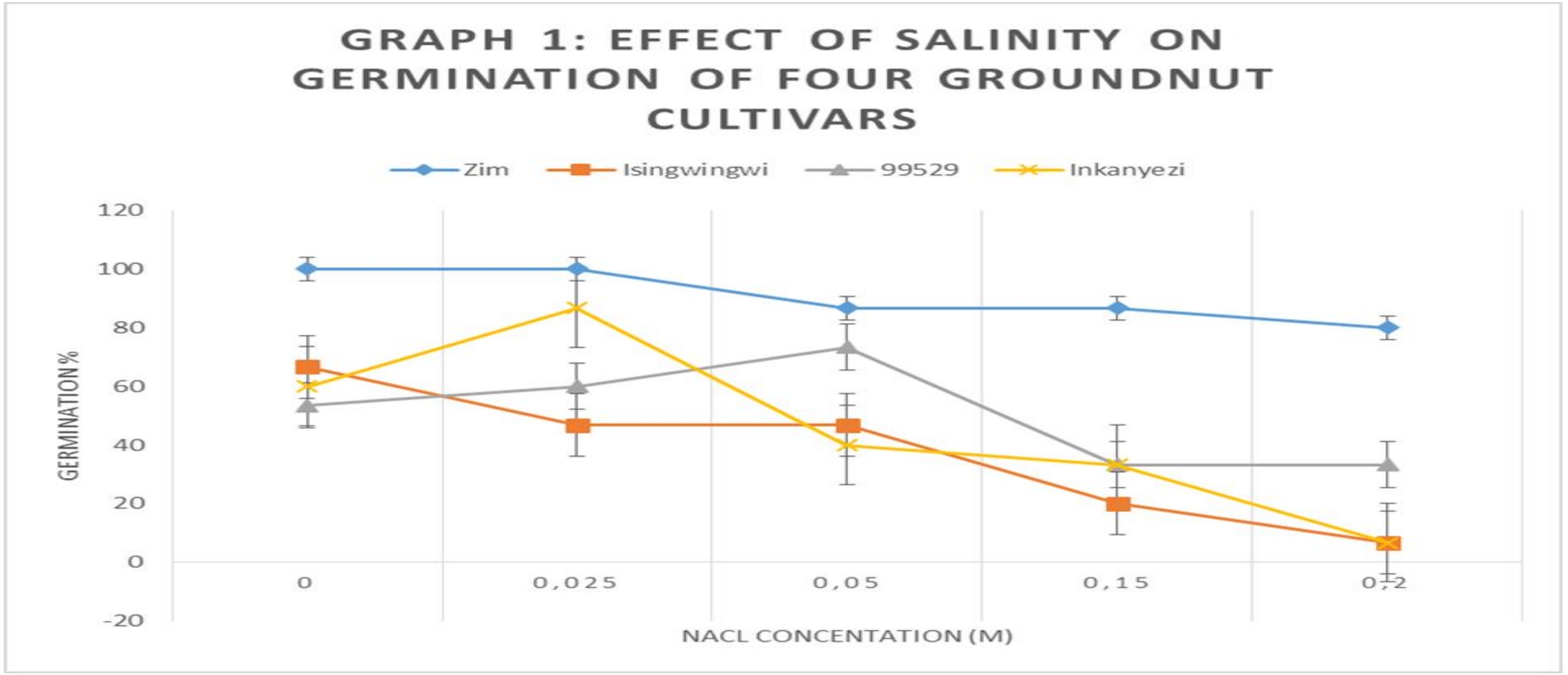
Results and Discussion

- Table 3: Effect of different NaCl concentrations on germination percentage of four groundnut cultivars. Values are means of three replicates.

Cultivars	NaCl Concentrations (M)					
	0.0 M	**0.025 M**	**0.05 M**	**0.15 M**	**0.20 M**	**Averages**
Zim	100	100	86.7	86.7	80	90.7
Isingwingwi	66.7	46.7	46.7	20	6.7	37.3
99529	53.3	60	73.3	33.3	33.3	50.7
Inkanyezi	60	86.7	40	33.3	6.7	45.3
Average	70	73.3	61.7	43.3	31.7	
$LSD_{0.05}$	S*	S*	S*	S*	S*	

*S= Significant,
LSD(0.05) Cultivar=12.92; NaCl=14.45; Cultivar × NaCl=28.90
CV (%) = 31.3

Results and Discussion



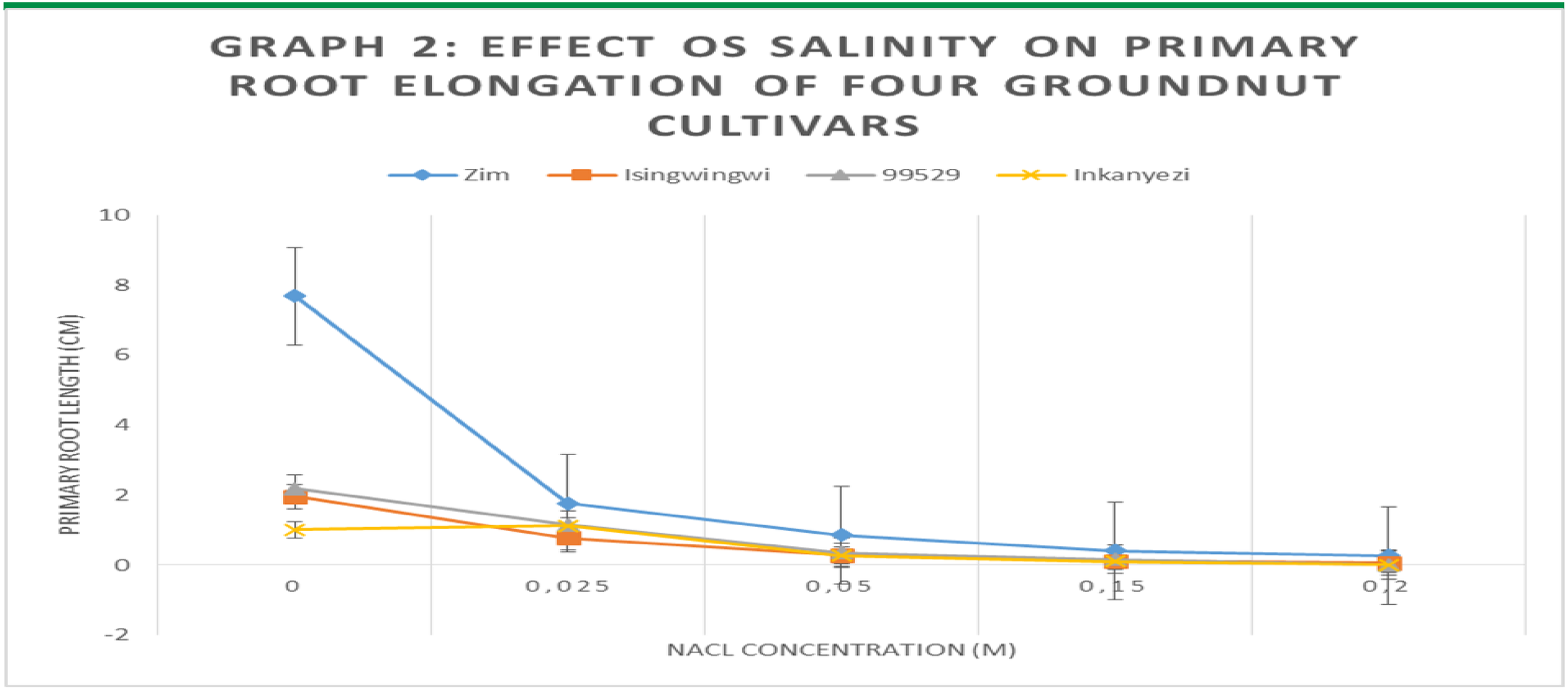
Results and Discussion

- Table 4: Effect of different NaCl concentrations on primary root elongation of four groundnut cultivars. Values are means of three replicates.

Cultivars	NaCl Concentrations (M)					
	0.0 M	**0.025 M**	**0.05 M**	**0.15 M**	**0.20 M**	**Averages**
Zim	7.69	1.76	0.86	0.41	0.27	2.20
Isingwingwi	1.95	0.78	0.28	0.12	0.07	0.64
99529	2.18	1.15	0.36	0.15	0.00	0.77
Inkanyezi	1.01	1.13	0.27	0.11	0.01	0.51
Average	3.21	1.20	0.44	0.20	0.09	
$LSD_{0.05}$	S*	S*	S*	S*	S*	

*S= Significant ,
LSD(0.05) cultivar=0.47; NaCl=0.53; Cultivar × NaCl=1.05
CV (%) = 142.2

Results and Discussion



Conclusion and recommendations

- The research revealed that an increase in salt stress reduces germination percentage of the four groundnut cultivars.
- Cultivar ‘Zim’ can tolerate salt stress to a larger extent due to the fact that a germination percentage of 80 % was attained at the highest concentration of 0.20 M.
- An increase in salt stress also induces a decrease in primary root elongation.
- A future study of investigating the gene that enabled cultivar ‘Zim’ to withstand salt stress can be conducted.

References

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THANK YOU