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The effect of cement as lime on rosette disease and cercospora leaf spot on groundnut grain yield

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***Abstract*— *Groundnut (Arachis hypogaea L.) is one of the world's major food legume crops that is severely affected by early leaf spot and groundnut rosette disease in Sierra Leone. The recent decline in yields of groundnut in Sierra Leone has been associated with the low calcium application. Therefore, a study was conducted to assess the potential of cement as lime in ameliorating rosette disease problem and low yield of groundnut in Sierra Leone. This experiment was conducted under field conditions at Njala, Kori chiefdom. The experimental design was a randomized complete block with five (5) treatment of cement application (0, 50, 100, 200 & 400 kg/ha). Disease severity for the rosette leaf spot was assessed based on a 1-3 scale while cercospora leaf spot was 1-9 scale for 39 high yielding groundnut lines. The application of cement at 0, 50, 100, 200, & 400 kg/ha did not have any significant influence on the incidence and severity of rosette or cercospora diseases. However, the improved lines ICGV 1954, ICGV 7445, ICGV UGA 2, ICGV 10900, ICGV 6284, ICGV 7437, and ICGV 9407 produced significantly higher yields and good resistance to cercospora leaf spot and groundnut rosette disease and were selected as potential candidates for release and future breeding programs. This study showed that cement could not be used as a control for early leaf spot and rosette disease. Therefore, farmers should plant groundnut varieties that are resistant to cercospora leaf spot and rosette disease for higher yields.*

***Keywords*— Groundnut, Cement, Lime, Cercospora Leaf Spot, Groundnut Rosette.**

I. INTRODUCTION

Groundnut (Arachis hypogaea L.), also known as earthnut or peanut, is a member of the papillionaceae, the largest and most important of the three (3) division of leguminosaea and extensively cultivated crop of the world (Aquilar, 2001). Groundnutis one of the world's major food legume crops. The crop is a native to the region in Eastern South America, where a large number of wild species are known to exist (Weiss, 2004; krapovickas, 2000), and extending into North Argentina (Ramanatha Rao, 2003). In the 16th century, it was brought to Europe and then Africa and Asia by Portuguese traders (purseglove,1988). It has been suggested on the basis of genuine donation that Arachis condinosil (2n) and Arachis batizocoi (k & G) are the dominant parent and occur in reasonable proximity in Bolivia (Weiss, 2004). The Portuguese traders took groundnut from Brazil to West Africa in the 16th century (Purseglove, 1988). Later the Spaniard hit across the pacific to the Philippines from where they spread to China, Japan, Malaysia, India, and Madagascar. The oldest indication of groundnut cultivation are from the pre-Colombia native societies of Peru, 2000-3000 BC well to the North – West from which it can reasonably be assumed to have had much longer history of domestication by the predecessor of the Arawak – speaking people who now live in the lowlands (Weiss, 2004).

Another route to Asia was from the West Coast of South America and hence to India. Africa can now be regarded as a substantial center of diversity. Some widely grown varieties in the United States of America may well have come from Africa since they do not occur naturally in America (Weiss, 2004). Many Africans will not believe that the groundnut is an introduced crop.

Groundnut is a widely cultivated grain legume in Sierra Leone. The total area under groundnut cultivation was

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estimated to be about 150,000 ha in 2003, with a very low yield of 0.2 t/ha, giving a total production of only 34,486 Mt (Crop production Guidelines, 2005). Production is predominantly practiced in the northern and southern parts of the country. It is grown twice annually. The first planting is done in May – June, second planting in late August-early September and in January mainly in lowlands (dry season). The minimum requirement for a typical food basket in 2007 is 1000002,183 Mt, according to the Ministry of Agriculture Forestry and Food Security (MAFFS) Medium Term Agricultural Strategic plan.

Groundnut provides a regular source of cash income for many small-scale farmers who sell the harvested unshelled nuts both raw and dried. The raw nut can be consumed either directly or in the boiled form. The dried nuts usually are roasted and sold for direct consumption. They can also be roasted, peeled, and mixed with molten sugar to make groundnut cake or grind into a paste to use as an ingredient in a popular local groundnut soup dish and a local snack Kanya. The fodder and residue (cake) after oil extraction are useful as livestock feed (FAO, 2005). Groundnut is grown either for direct use or for oil and for the high protein meal produced after extraction (Asiedu, 2006). Groundnut crops are grown for their kernels, the oil and meal derived from them and the vegetable residue (haulm). As human food, the kernels are eaten raw, highly roasted, or boiled. Sometimes salted or made into a paste, which is known as peanut butter (Nigam et al. 2004).

Groundnut is an important cash crop and a source of protein in Sierra Leone, and many other developing countries where animal protein is low.Groundnut is a highly nutritious food. It is a meal produced by extracting the oil is rich in protein, mineral, and vitamins. The average chemical composition of shelled groundnut is approximately 11.7% carbohydrate, 46.8% fat, 30.4% protein, 28% fiber, 2.3% ash, and 5.4% water. The oil contains about 53% oleic acid and 25% linoleic acid. Decorated groundnut cake also contains about 23.2% carbohydrate, 46.8% protein, 7.5% fat, 6.4% fiber, 5.8% ash, and 10.3% water. Groundnut is rich in calcium, phosphorus, and iron, and they constitute an excellent source of the vitamin thiamin, riboflavin, niacin, but not of vitamin A and C (Murant et al. 2000). The groundnut kernel is composed of approximately equal weight of fatty and non-fatty constituent, the relative amount of each depending upon variety and maturity. As in many of the seeds of other legumes, the protein is nutritionally inferior to that of the standard reference protein (SRP), which approximates the average amino acid profile of human protein. This is because it contains relatively small proportions of lysine, methionine, thiamine, and sometimes isoleucine and valine. 100g of raw groundnut kernel provides about 570 lca; (2.39 kj) of dietary energy (Giftarist, 2010). Groundnut are useful sources of tocopherol (vitamin E) of dietary energy (Giftarist, 2010).

Groundnut is important in terms of its content and its ability to fix nitrogen in soil through the symbiotic relationship with the bacteria Rhizobium spp., (Lahai and Moseray,2001). It can be consumed locally and used in the food industry. In Sierra Leone, Considerable quantities are consumed locally by a large proportion of the population and also provide supplementary cash income to women farmers. Revenue generated from groundnut is normally used to meet the educational and health challenges faces by families of resource-poor farmers.

Although groundnut is the most important leguminous crop in Sierra Leone, yields have declined dramatically over the past 20 years (less than 1 t/ha), which has a direct effect on the income and welfare of poor resource farmers. Changes in environmental climate poses a threat of yield fluctuation from year to year (Fornah et al., 2020; Raun et al., 2017; Raun et al., 2019). It is not clear whether the low yields of groundnut are a result of climatic changes, declining soil fertility, unavailability of quality improved seeds, or prevalence of diseases and pests. However, the low yields could be attributed to the high susceptibility of the cultivated groundnut varieties to early leaf spot and rosette diseases prevalent countrywide.

Early leaf spot of groundnut (Arachis hypogaea L.) caused by (Mycosphaerella arachidis Deighton) is a disease of universal importance (Smith,2006). Leaf spots are the most severe diseases of groundnut on a worldwide scale. The two fungi commonly involved are Mycosphaerella arachidis and Deighton Hori, causing early leaf spots, and late leaf spot (MucosphaerellaBerkeley Jenkins, (Kirk, 2004). Both diseases are economically the most important fungal diseases of groundnut in Nigeria and worldwide. In most areas, both diseases occur together, but the incidence and severity of each disease vary with environment and cultivars (Pande& Rao 2001). The disease is characterized by the appearance of leaf defoliation and necrotic lesions on leaves, petioles and stems. On susceptible groundnut genotypes, Mycosphaerella arachidis produces abundant conidia on mature lesions. Leaf spots damage the plant by reducing the available photosynthetic area, by lesion formation, and the stimulating leaflet abscission. The leaf spot diseases can cause a 30%-70%

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loss in pod yield and reduction in the kernel quality (smith,2006). Early leaf spot alone can cause 35%-50% defoliation at the peak flowering stage and yield losses may reach 20%-25%(subrahmanyam et al.,2003). The relative importance of each disease varies from place to place and from season to season, depending on the cropping system and the environmental conditions (Godfrey and Olorunju ,2009).

The rosette is another devastating disease for the productivity of groundnut. Rosette is caused by a complex of two viruses and a satellite RNA (Taliansky et al, 2000) This indicates that the virulence of the two pathogens has a different genetic basis. It is transmitted in a persistent manner and over 92% transmission occurs within ten minutes of the beginning of the inoculation access period (Taliansky et al, 2000). According to Alegbejo (1997), groundnut rosette virus (GRV) is the most destructive disease of groundnut. The rosette virus disease can cause considerable losses on the groundnut. In association with drought, the virus can cause yield losses of up to 100% (Van Der Merwe and subrahmanyan, 1997). The virus infection causes chlorotic rosette, mosaic rosette, and green rosette symptoms (Reddy, 2000) chlorotic rosette characterized by severe stunting of plats with isolated flecks or dark green colored leaves, is more prevalent in East and Central Africa. Younger leaflets show conspicuous mosaic symptoms and stunting is rather less pronounced than for chlorotic rosette. Green rosette, characterized by slight mottling of young leaflets and the presence of yellow leaves with green veins, occurs only in West Africa and Uganda. Plants infected with chlorotic rosette bear smaller, curled and distorted leaflets, the stunting of the plant depends on the time of infection.

Presently, there is a lack of improved groundnut varieties that are resistant to cercospora and rosette diseases in the country. The release variety,SLINUT 1 and the popular local variety Mares have been observed to be susceptible to leaf spot and groundnut rosette virus disease. Losses due to leaf spots and rosette diseases are major constraints to groundnut production . Farmers do not practice disease control procedures and perceive dead leaves as signs of crop maturity. In controlling the two major diseases, leaf spot and rosette, host –plant resistance is considered the most cost-effective control measure. The identification and utilization of stable resistance is of high priority.

There is a need to screen improved genotypes of the crop, which will ultimately lead the identification, recommendation, and potential release of varieties that are resistant to ground rosette virus and cercospora leaf spot diseases. Also, the development of technologies that will prevent these diseases will reduce yield losses to farmers and increase groundnut production and productivity.

This study aims to increase the productivity of groundnut and improve the livelihood of groundnut farmers in Sierra Leone. The specific objectives are: To determine the effect of cement application as lime on the incidence and severity of cercospora leaf spot (Mycosphaerella arachidis Deighton)and groundnut rosette diseases of groundnut and to screen introduced groundnut lines for high yield and resistance of cercospora leaf spot and groundnut rosette diseases under field conditions.

II. MATERIALS AND METHOD

2.1 Description of Study Area

The study was conducted in Njala, Kori chiefdom, which is located in the eastern part of Moyamba District. Njala is situated at an elevation of 50m above sea level on 06N latitude and 120 06W longitude. There are two distinct seasons, the wet season (May to October) and the dry season (November to April). Mean annual rainfall at Njala is 2526mm, mean monthly maximum air temperature range from 29^0C to 34^0C, while mean minimum air temperature range from 210C to 23^0C. Relatively humidity is very high, often close to 100% for the greater part of the day and night, especially during the rainy season (Odell et al., 1974). During the dry season, potential evapotranspiration.

Njala is in the transition forest, and the predominant vegetation is secondary bush. The soils at the experimental sites belong to the Njala series (Orthoxicpalehumult). Textures are usually gravely clay loam in the surface and gravely clay loam to gravely clay in the subsoil. The soils are low in soil moisture and have a very nutrient status and are slightly acidic, with pH ranging from 5.5 to 6.0 (Odell et al., 1974).

Two experiments were carried out at different experimental sites. The first experiment was conducted at the Njala University experimental site and the second experiment was held at the Sierra Leone Agricultural Research Institute (SLARI) experimental site.

2.2 Experiment 1

This experiment was carried out during second cropping season in 2010. The experimental area was cleared and

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plowed using hand hoe, and shovel. Flat-topped seedbeds were constructed, aided by the use of pegs and garden lines. The experimental design was a 2-factor randomized complete block with three (3) replications. Factor A consisted of cement application, while factor B consisted of the time of cement application. A long seedbed comprised of five (5) treatments made up each replication. Each replication consisted of five (5) main plots, and each main plot consisted of five subplots. The main plots constituted the cement application while the subplots time of application. The total experimental area was 32 X 10m and the distance between each replication was 1m. Each plot measured 9.5m x 1.5m and the distance between each subplot is 0.5m apart.

Five rates of cement 0, 50, 100, 200 and 400 kg/ha were applied while N.P.K was applied at a uniform rate. The groundnut variety was SLINUT 1 (JL 24).

Planting was done on the 29th of September 2010. The groundnut variety was shelled a day prior to the planting date and healthy seeds were selected for planting. Two seeds were sown per hill.

The first application of cement and N.P.K on the groundnut field was done on the 7th October, which was applied at various rates in the various subplots. The first weeding was done on the 14th of October and after the weeding, the germination rate increases and was satisfactory. The vegetation around the periphery of the field was brushed down for other experiments and this helps to prevent insect and rodent infestation. Thinning was later carried out in order to reduce competition in the field.

2.3 Experiment 2

This trial was carried out as the SLARI – Njala Agricultural Research Centre during the second cropping season in September 2011. Thirty-eight (38) improved lines groundnut tested and certified by the International Crops Research Institute for Semi-Arid Tropics (ICRISAT), and one improved line obtained from Egypt (courtesy from Dr. Susan Roberts) SU-EGYPT was obtained from the Sierra Leone Agricultural Research Institute (SLARI), Njala Agricultural Research Center (NARC). The treatment included these 39 newly introduced groundnut lines and two local varieties, Mares and SLINUT 1 were planted. Seeds were sown in two rows at a planting distance of 30cm between rows and 15cm within rows. Each plot size was 30.5cm x 1.85cm (56.425 cm2). The total experimental area was 46.27 m2. A randomized complete block design with two replications was used in the study. The plants were thinned to 1 plant/hill two weeks after planting. Weeding was done at three weeks after planting and no fertilizer application was done.

2.4 Data Collection

Data for the first experiment was collected from ten tagged plants selected from the four (4) middle rows, excluding the two border rows in the first experiment. Data for the second experiment was collected from ten tagged plants randomly selected. Morphologically data on the number of leaves, number of branches, fresh weight pod, dry weight pod, and the number of plants harvested in each plot was measured on ten (10) tagged plants on two weeks basis. The incidence and severity of Mycosphaerella arachidis Deighton and the rosette virus were collected based on various scales. The scale for severity was based on a 1-9 scale, where; 1=no symptom, 2=1-5%, 3=6-10%, 4=11-20%, 5=21-30%, 6=31-40%, 7=41-60%, 8=61-80%, 9=81-100% leaf area with symptoms (Subrahmanyam et al., 1995). The 1-3 scale was used for assessing severity in rosette virus, where; 1=no symptoms, 2=medium and 3=severe (www.surgicalcriticalcare.net/Resources/injury, 2001). Percent defoliation was calculated from 4N-L/4N X 100, where N=total number of nodes and L=the number of leaflets present.

Harvesting of pods was 120 days after sowing and lasted for a day. The groundnut was uprooted manually, pods plucked from the plant and the fresh pods were weighted per each plot and weight recorded. The pods were categorized into filled and unfilled and weighed individually. The pods were late dried into constant weight and recorded.

2.5 Data Analysis

Data collected on various parameters were analyzed using Genstat statistical package (Genstat release version 7.2 DE). A two-way analysis of variance was done and the least significant difference at 5% probability ($p<0.05$) was used for mean separation (Gomez and Gomez, 1984).

III. RESULT AND DISCUSSION

3.1 Experiment 1

3.1.1 Effect of cement application on the incidence and severity of early leaf spot disease on groundnut

The results of the first experiment showed that the incidence and severity of early leaf spot on SLINUT 1 variety were low at 1 month after planting (MAP) and increased dramatically at 2 and 3 MAP. A significant difference was observed on leaf

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spot incidence at different rates of cement application at 1 MAP (Table 1). The 0 and 50 kg/ha cement application treatments had significantly (P<0.05) higher cercospora leaf spot disease incidence than the 100, 200, and 300 kg/ha cement application rates. However, at 2 and 3 MAP, no significant difference was observed in early leaf spot disease incidence on SLINUT 1.Similar trend was also observed for early leaf spot severity at 2 and 3 MAP except for the 0 cement application rate which had significantly higher severity scores than the other application rates at 2 MAP. The interaction between MAP and rate of cement application on cercospora incidence was significant which shows that MAP highly influenced the disease. The response of SLINUT 1 to the cement application can be attributed the increasing susceptibility of the variety to the disease over the years to frequent exposure to the pathogen.

Table 1: Incidence and Severity of Cercospora Leaf Spot Disease on SLINUT 1 as affected by rate of cement application assessed at Njala

Rate of cement Application kg/ha		Incidence			Severity	
MAP	1 MAP	2 MAP	3 MAP	1 MAP	2 MAP	3 MAP
0	60	100	100	2	6	9
50	48	100	100	2	5	9
100	46	100	100	2	5	9
200	46	100	100	2	5	9
400	46	100	100	2	5	9
Mean	49.2	100	100	2	5	9
LSD (0.05) MAP X Rate of cement		1.32			0.1	
CV (%)		2.2			2.7	

3.1.2 Cercospora disease incidence and severity on SLINUT 1 as affected by rate of cement application and time of application

time and rate of cement application showed significant different. 100 kg/ha application of lime had the highest incidence of 90% followed by zero application of cement with disease incidence of 87.78% at planting (Table 2). The first application at planting appeared to suppress the incidence of cercospora leaf spot; however, successive applications at flowering and pegging had no significant effect on cercospora leaf spot.

Zero application of cement had the highest disease severity score of 5.78 significantly compared to all the other treatments that had a severity score of 5.33 and did not respond to the time of application and rate of cement application.

3.1.3 Effect of cement application on the incidence and severity of groundnut rosette disease on SLINUT

No significant difference in rosette incidence was observed on the SLINUT 1 variety at the different months after planting (Table 3) with varying cement applications. The highest incidence of rosette (100%) was observed at 2 and 3 months after planting for all the cement application rate (Table 3). The high incidence and severity of rosette disease resulted to absence of filled pods. This made it impossible to collect any meaningful yield data. These results are in agreement with those of Van Der Merwe and Subrahmanyan (1987), who reported that in association with drought, the rosette virus could cause up to 100% yield losses.

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Table 2: Incidence of cercospora leaf spot disease on SLINUT 1 as affected by rate of cement application and time of application

Time of cement Application	Rate of cement application (kg/ha)					
	0	50	100	200	400	Mean
Planting	87.78	84.44	90	80.07	84.44	85.34
Flowering	83.38	83.33	83.33	83.33	80.05	82.68
Pegging	83.33	83.33	83.33	80	80	82
Half at planting and half at flowering	83.33	84.04	82.21	80	80	81.92
Half at planting and half at pegging	83.33	83.33	83.33	80	80	82
Mean	84.23	83.69	84.44	80.68	80.9	
CV		2.2				
LSD Rate of cement application		0.77				
LSD Time of cement application		0.77				
LSD Rate x of cement application		1.32				

Table 3 : Incidence of severity of groundnut rosette disease on SLINUT 1 as affected by rate of cement application at Njala University

Rate of cement application	Rosette Incidence			Rosette Severity	
kg/ha	1 MAP	2 MAP	3 MAP	1 MAP	2 MAP
0	70	100	100	2	2
50	70	100	100	2	2
100	70	100	100	2	2
200	70	100	100	2	2
400	70	100	100	2	2
Mean	70	100	100	2	2
LSD (0.05) MAP X Rate of cement		NS		NS	
CV (%)		0		0	

3.1.4 Incidence and severity of groundnut rosette disease on SLINUT 1 as affected by rate of cement application and time of application

No significant difference was observed with time, and the rate of cement application incidence of groundnut increased 70% to 100% from 1 MAP to 3 MAP. However, incidence was 90% at all rates and time of application.

3.2 Experiment 2

3.2.1Leaf number and percentage leaf defoliation of the groundnut lines.

The results showed high significant interaction ($p<0.001$) between month after planting and variety for the lines tested in both the number of leaves and percentage leaf defoliation. Leaf number reduced drastically from 2 MAP to 3 MAP in almost all the groundnut lines. Significantly higher numbers of leaves were recorded at 2 MAP than 3 MAP (Table 4). This might be due to increased defoliation caused by cercospora leaf spot and leaf senescence. Conversely, leaf defoliation was much higher at 3 MAP than 2 MAP (Table 4). The improved variety ICGV 7878, which had the highest defoliation also had the least pod yield (Table 4). The leaf defoliation percentage

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among varieties was not significant. However, some improve varieties (ICGV 7171, ICGV 73-33, ICGV 7445, ICGV 7550) had low defoliation percentage compared to the local varieties (SLINUT and MARES) (Table 5).

3.2.2 Mean cercospora incidence and severity of the groundnut lines

Incidence and severity of cercospora leaf spot on groundnut lines are presented in Table 6. It was observed that several lines of introduced groundnut were resistant to cercospora leaf spot. These include ICGV 11337, ICGV 11485, ICGV 1954, ICGV 6238, ICGV 7436, ICGV 7452, ICGV 7454, ICGV 7456, ICGV 7550, ICGV 92082, ICGV 92087 and ICGV UGA. These results conform with similar results obtained by Murata et al., (2008). The incidence of cercospora leaf spot was 0% at 2 MAP among the lines tested, while the mean incidence of cercospora leaf spot of 16.7% was recorded at 3 MAP. Generally, the mean incidence of cercospora leaf spot ranged from 0 to 30%, while the severity scores ranged from 1 to 3 (Table 6).

Table 4 : Leaf number of the groundnut lines assessed at 2 and 3 months after planting at Njala

Variety	2 MAP	3 MAP	Mean
ICGV 10900	210.5	109.5	160.0
ICGV 11337	196.5	111.5	154
ICGV 11485	206.5	98.5	152.5
ICGV 11682	194.5	126.5	160.5
ICGV 1194	161.5	133.5	147.5
ICGV 13919	137.5	100.5	119
ICGV 1766	249.5	152.5	201.0
ICGV 1954	286.5	175.5	231.0
ICGV 2481	213.5	126.5	170
ICGV 3700	125.5	116.5	121
ICGV 47-10	245.5	106.5	176
ICGV 6284	240.5	96.5	168.5
ICGV 6337	233.5	99.5	166.5
ICGV 643	234.5	154.5	194.5
ICGV 6466	304.5	121.5	213
ICGV 6812	94.5	92.5	93.5
ICGV 7171	187.5	98.5	143
ICGV 73-33	195.5	121.5	158.5
ICGV 7436	230	99.5	164.8
ICGV 7437	257.5	175.5	216.5
ICGV 7445	183.5	127.5	137
ICGV 7446	237.5	90.5	182.5
ICGV 7449	259.5	160.5	210
ICGV 7452	144.5	124.5	134.5
ICGV 7454	118.5	108.5	113.5

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ICGV 7455	256.5	112.5	184.5
ICGV 7456	277.5	149.5	213.5
ICGV 7550	235.5	91.5	163.5
ICGV 7878	162.5	102.5	132.5
ICGV 8298	248.5	101.5	175
ICGV 92041	263.5	117.5	190.5
ICGV 92082	207.5	140.5	174
ICGV 92087	284.5	143.5	214
ICGV 9407	230.5	126.5	178.5
ICGV 96808	129.5	124.5	127
ICGV 96814	228.5	100.5	164.5
ICGV 96855	329.5	121.5	225.5
ICGV UGA 2	250.5	148.5	199.5
MARES	255.5	131.5	193.6
SLINUT	196.5	98.5	193.5
SU, EGYPT	331.5	144.5	147.5
Mean	220.4	121.5	238
LSD (0.05)VAR x MAP	0.15		
CV (%)	2.1		

Table 5: Percentage leaf defoliation of the groundnut lines at 2 and 3 months after planting at Njala

Variety	2 MAP	3 MAP	Mean
ICGV 10900	15.1	12.7	13.9
ICGV 11337	7.3	16.4	11.9
ICGV 11485	15.4	16.2	15.8
ICGV 11682	16.2	15.4	15.8
ICGV 1194	16.4	17.4	16.9
ICGV 13919	16.7	14.5	15.6
ICGV 1766	15.6	15.7	15.7
ICGV 1954	15.5	15.8	15.7
ICGV 2481	15.3	15.2	15.3
ICGV 3700	13.6	15.2	14.4
ICGV 47-10	14.8	15.1	15
ICGV 6284	15.2	15.1	15.2
ICGV 6337	16.5	15.4	16
ICGV 643	15	16.4	15.7

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ICGV 6466	16	14	15
ICGV 6812	13.8	15.7	14.8
ICGV 7171	15	13.3	14.1
ICGV 73-33	14.4	14	14.2
ICGV 7436	14.3	15.4	14.9
ICGV 7437	15.1	15.5	15.3
ICGV 7445	15.2	7.3	11.3
ICGV 7446	17.4	16.8	17.1
ICGV 7449	15.6	15	15.3
ICGV 7452	14.5	16.6	15.5
ICGV 7454	13.7	16.2	15
ICGV 7455	16.5	15.7	16.1
ICGV 7456	16.2	15.5	15.8
ICGV 7550	14.5	6.3	10.4
ICGV 7878	15.7	15.7	15.7
ICGV 8298	15.9	13.7	14.8
ICGV 92041	16.4	14.4	15.4
ICGV 92082	16.3	14.9	15.6
ICGV 92087	15.6	15.1	15.4
ICGV 9407	15.2	15.2	15.2
ICGV 96808	15.4	16.6	16
ICGV 96814	15.1	14.5	14.8
ICGV 96855	15.6	14	14.8
ICGV UGA 2	16.3	16	16.2
MARES	15.8	14.1	15
SLINUT	14	16.2	15.1
SU, EGYPT	16	16.4	16.2
Mean	14.2	15.9	
LSD (0.05)VAR x MAP	0.5		
CV (%)	1.7		

Table 6: Incidence and severity of cercospora leaf spot among improved groundnut lines assessed at Njala

Variety	Incidence	Severity
ICGV 10900	10	2
ICGV 11337	0	1
ICGV 11485	0	1

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ICGV 11682	15	2
ICGV 1194	12.5	2.5
ICGV 13919	10	2.5
ICGV 1766	10	2.5
ICGV 1954	15	1
ICGV 2481	15	3
ICGV 3700	10	2
ICGV 47-10	10	2
ICGV 6284	0	1
ICGV 6337	10	2
ICGV 643	10	2
ICGV 6466	15	1
ICGV 6812	0	2
ICGV 7171	10	2
ICGV 73-33	10	2
ICGV 7436	0	1
ICGV 7437	15	3
ICGV 7445	0	1
ICGV 7446	0	1
ICGV 7449	10	2.5
ICGV 7452	0	1
ICGV 7454	0	1
ICGV 7455	15	3
ICGV 7456	0	1
ICGV 7550	0	1
ICGV 7878	10	2
ICGV 8298	10	2
ICGV 92041	10	2
ICGV 92082	0	1
ICGV 92087	0	1
ICGV 9407	10	2
ICGV 96808	15	2
ICGV 96814	15	2.5
ICGV 96855	10	2
ICGV UGA 2	0	1
MARES	15	3

SLINUT	10	2
SU, EGYPT	15	2.5
Mean	8.4	1.9
LSD (0.05)VAR	1.1	0.2
CV (%)	9.3	8.2

4.1.3 Incidence and severity of groundnut Rosette disease among introduced groundnut lines at Njala

There was a significant interaction between months after planting and variety. At 2 MAP both rosette incidence and severity were nil. At 3 MAP, varieties ICGV 92041 and ICGV 6248 recorded the highest rosette incidence (35%). Similar results were also obtained for disease severity scores (2 and 1.9), respectively. Resistance to rosette was found in ICGV 10900, ICGV 11485, ICGV 2481, ICGV 73-33, ICGV 7550, ICGV 92087, ICGV 96814, Mares and SU, EGYPT (Tables 7 and Table 8). ICGV 7454, although it had 10% rosette incidence and 1.6 severity score, it still yielded the highest. This demonstrates a high tolerance for the disease.

4.1.4 Pod yield (t/ha) of the groundnut lines

Highly significant differences were observed in pod yield among the groundnut lines evaluated. The introduced line ICGV 1954 had the highest pod yield (1.96t/ha), followed by ICGV 7445 (1.94 t/ha), another introduced line whilst ICGV 7878 had the lowest yield (Table 9). The low yield obtained by ICGV 7878 could be due to its low leaf number as a result of the high leaf defoliation rate at 2 and 3 MAP. The following improved varieties tested significantly out-yielded the local checks Mare and SLINUT 1, ICGV 10900, ICGV 1954, ICGV 6466, ICGV 6284, ICGV 7437, ICGV 7445, ICGV 8298, ICGV 9407 and ICGV 7458 (Table 9). Although these varieties had some incidence of cercospora and rosette, their severity scores were very low, demonstrating some level of resistance to those diseases.

Table 7: Incidence of groundnut rosette disease assessed at 2 and 3 months after planting at Njala

Variety	2 MAP	3 MAP	Mean
ICGV 10900	0	0	0
ICGV 11337	0	25	12.5
ICGV 11485	0	0	0
ICGV 11682	0	20	10
ICGV 1194	0	20	10
ICGV 13919	0	15	7.5
ICGV 1766	0	15	7.5
ICGV 1954	0	20	10
ICGV 2481	0	0	0
ICGV 3700	0	15	7.5
ICGV 47-10	0	25	12.5
ICGV 6284	0	35	17.5
ICGV 6337	0	20	10
ICGV 643	0	10	5
ICGV 6466	0	25	12.5

ICGV 6812	0	10	5
ICGV 7171	0	10	5
ICGV 73-33	0	0	0
ICGV 7436	0	30	15
ICGV 7437	0	15	7.5
ICGV 7445	0	15	7.5
ICGV 7446	0	15	7.5
ICGV 7449	0	25	12.5
ICGV 7452	0	15	7.5
ICGV 7454	0	20	10
ICGV 7455	0	25	12.5
ICGV 7456	0	10	5
ICGV 7550	0	0	0
ICGV 7878	0	10	5
ICGV 8298	0	10	5
ICGV 92041	0	35	17.5
ICGV 92082	0	15	7.5
ICGV 92087	0	0	0
ICGV 9407	0	20	10
ICGV 96808	0	20	10
ICGV 96814	0	0	0
ICGV 96855	0	20	10
ICGV UGA 2	0	15	7.5
MARES	0	0	0
SLINUT	0	10	5
SU, EGYPT	0	0	0
Mean	0	14.4	
LSD (0.05)VAR x MAP	6.7		
CV (%)	46.6		

Table 8: Severity of groundnut rosette disease assessed at 2 and 3 months after planting at Njala

Variety	2 MAP	3 MAP	Mean
ICGV 10900	1	1	1
ICGV 11337	1	2	1.5
ICGV 11485	1	1	1
ICGV 11682	1	2	1.1

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ICGV 1194	1	1.5	1.25
ICGV 13919	1	1.6	1.5
ICGV 1766	1	1.4	1.2
ICGV 1954	1	1.6	1.3
ICGV 2481	1	1	1
ICGV 3700	1	1.7	1.4
ICGV 47-10	1	1.8	1.4
ICGV 6284	1	1.9	1.5
ICGV 6337	1	1.8	1.4
ICGV 643	1	1.4	1.2
ICGV 6466	1	1.4	1.2
ICGV 6812	1	1.6	1.3
ICGV 7171	1	1.2	1.1
ICGV 73-33	1	1	1
ICGV 7436	1	2.1	1.6
ICGV 7437	1	1.4	1.2
ICGV 7445	1	1.9	1.5
ICGV 7446	1	1.6	1.3
ICGV 7449	1	2	1.5
ICGV 7452	1	2.2	1.6
ICGV 7454	1	1.6	1.3
ICGV 7455	1	1.6	1.3
ICGV 7456	1	1.5	1.3
ICGV 7550	1	1	1
ICGV 7878	1	1.4	1.2
ICGV 8298	1	1.2	1.1
ICGV 92041	1	2	1.5
ICGV 92082	1	1.2	1.1
ICGV 92087	1	1	1
ICGV 9407	1	1.6	1.3
ICGV 96808	1	1.4	1.2
ICGV 96814	1	1	1
ICGV 96855	1	1.4	1.2
ICGV UGA 2	1	1.4	1.2
MARES	1	1	1
SLINUT	1	1.2	1.1

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SU, EGYPT	1	1	1
Mean	1	1.5	
LSD (0.05)VAR x MAP	0.13		
CV (%)	5.5		

Table 9: Pod yield (t/ha) of groundnut lines assessed at Njala.

Variety	Pod yield (t/ha)
ICGV 10900	1.64
ICGV 11337	1.05
ICGV 11485	1.16
ICGV 11682	0.56
ICGV 1194	0.66
ICGV 13919	1.05
ICGV 1766	0.55
ICGV 1954	1.96
ICGV 2481	0.88
ICGV 3700	0.77
ICGV 47-10	0.56
ICGV 6284	1.56
ICGV 6337	0.53
ICGV 643	0.72
ICGV 6466	1.49
ICGV 6812	0.77
ICGV 7171	0.53
ICGV 73-33	0.55
ICGV 7436	0.66
ICGV 7437	1.49
ICGV 7445	1.94
ICGV 7446	0.66
ICGV 7449	0.66
ICGV 7452	0.88
ICGV 7454	0.56
ICGV 7455	1.29
ICGV 7456	0.66
ICGV 7550	0.83
ICGV 7878	0.54

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ICGV 8298	1.20
ICGV 92041	0.65
ICGV 92082	0.68
ICGV 92087	1.11
ICGV 9407	1.39
ICGV 96808	0.63
ICGV 96814	0.55
ICGV 96855	0.65
ICGV UGA 2	1.83
MARES	0.65
SLINUT	1.12
SU, EGYPT	0.75
Mean	0.94
LSD (0.05)VAR x MAP	0.71
CV (%)	37.7

The high yields observed among the above-mentioned lines could be due to their inherent genetic coupled with their ability to tolerate cercospora and rosette disease prevalent in the study area.

IV. CONCLUSIONS

From the results obtained from the first and second experiments, the following conclusions can be made: The application of cement at 0, 50, 100, 200 and 400 kg/ha did not have any significant influence on the incidence and severity of rosette or cercospora leaf spot diseases in groundnut.

Percentage leaf defoliation increases from 2 to 3 MAP as the incidence and severity of cercospora leaf spot increases while the reverse occurred for leaf number. The incidence and severity of cercospora leaf spot and rosette diseases were much higher after 2 MAP with the highest scores recorded at 3 MAP. The improved newly introduced lines with better tolerance to cercospora leaf spot and rosette diseases The local checks Mares and SLINUT 1 were susceptible to both cercospora leaf spot and rosette diseases and that the pod yield was determined both by genetic potential and the level of resistance to cercospora leaf spot and rosette diseases. The improved lines ICGV 1954, ICGV 7445, ICGV UGA 2, ICGV 10900, ICGV 6284, ICGV 7437 and ICGV 9407 with high yields and good resistance to cercospora leaf spot and rosette were selected as potential candidates for release and future breeding programs.

From the findings of the two experiments, it is recommended that;

Farmers should not apply cement as a control measure for cercospora leaf spot and rosette diseases in groundnut. The improved groundnut lines selected should be further evaluated as potential candidates for varietal release in multi-locations. The improved groundnut lines, ICGV 6812, ICGV 7456, ICGV 7550 and ICGV 982087 with low yields but high resistance to cercospora leaf spot and rosette diseases could be used as sources of parent material in breeding for resistance to these diseases. Farmers should plant groundnut varieties that are resistant to cercospora leaf spot and rosette for higher yields.

REFERENCES

[1] A.F. Murant, R. Rajeshwari, D.J Robinson,and J.HRaschke " A Satellite RNA of groundnut rosette virus that is largely responsible for symptoms of groundnut rosette diseases". Longman group limited, London 2000, pp 213-215

[2] A.Fornah, J. Dhillon and W. Raun"Changes in Check Plot Yields over Time in Three Long-Term Winter Wheat Experiments" *Communications in Soil Science and Plant Analysis*, 2020, *51*(2), 297-306.

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https://dx.doi.org/10.22161/ijhaf.4.4.6
ISSN: 2456-8635

[3] A.Gifterist"The uses of groundnut for medicinal processes and their effect on human health" Longman, London 2010, pp 234-235
[4] A.Krapovickas."The origin, variability and spread of groundnut (Arachis hypogea L.) In: The domestication and exploitation of plants and animals" Duckworth, London, U.K 2000, pp 424-440
[5] A.Taliansky, L.J Reddy, andM.E Ferguson, "The effect of groundnut rosette assistor virus on the agronomic performance of four groundnut genotypes" 2000, pp 23-25
[6] Crop Production Guidelines for Sierra Leone 2005 Pp 42-46.
[7] D.H Smith "A simple method for producing Mycosphaerella arachidis Deighton conidial inoculum". Phytopathology 2006, vol 61: pp 141
[8] D.V.R Reddy"Groundnut viruses and virus diseases: distribution, identification and control" Review of plant pathology,2000, vol 70 pp 665-677.
[9] E.A.Weiss "Agrometeology and groundnut production". Macmillan group limited press, London 2004, pp 89
[10] F. Aseidu"The effect of leaf spot on the yield and quality of the groundnut crop" Longman group limited, London, England. 2006, pp 64
[11] Food and Agriculture Organization "*FAO statistical yearbook"2005*.
[12] I.Aquilar, J. Manjarrez, and M. Bannayan"A global mapping system for bambana, groundnut" FAO monograph, Chapman and Hall, London. 2001, pp 56.
[13] I.Godfrey and P.E.Olorunju"Yield stability and Resistance to leaf spot diseases and rosette in groundnut" Czech J. Genet. Plant Breed., 45, 2009 (1):18-25
[14] J.W. Purseglove "Tropical crops" Dicotyledons, Longman, London 1988, pp 196-232
[15] K.A. GomezandA.AGomez. "Statistical procedures for Agricultural Research" 2nd ed. Wiley, New York, USA 1984 pp 222.
[16] M.D. Alegbejo, " Survey of the effect of imtercropping of groundnut with cereals on the incidence of groundnut rosette virus disease in Northern Nigeria". Internation Arachis Nwesletter, 1997, Vol 17,pp 39-40
[17] M.T Lahai, and M.T. Moseray"Production of pure groundnut seeds. A taining manual prepared for CARE on farm training in the Moyamba District", Sierra Leone Journal, 2001pp 11
[18] N.Murata "Seed borne viruses base on detection, identification on the groundnut seeds". Journal of plant pathology, Cambridge University, London 2000, pp 231-233
[19] P.J.A. Van der Merwe and P. Subrahmanyan, "Screening of rosette-resistance early groundnut breeding lines for yield and other characteristics" International Arachis Nwesletter,1997, vol 17: 23-24.
[20] P.Kirk "Fungorum. International Mycological Institute" 2004 available at http://www.indexfungorum.org.
[21] P.Subrahmanyam, G.LHilelebrand, andA.K. Singh "Screening for resistance to groundnut rosette" Oxford University press, London 2003, pp 78-79
[22] Ramanatha Rao "Botany, In: Groundnut" (Reddy, P.S., ed.). Indian Council of Research, New Delhi, 2003, pp 24-64
[23] R.T.Odell, W. Dijkerman,S.W. Van Vuure., S. Melsted, A.H. Beavers, P.M. Sutton, L.T. Kurtz and R. Miedema "Characteristic classification and adaptation of soils in selected areas in Sierra Leone" West Africa. Bulletin 748, Agricultural Experiment Station, College of Agriculture, University of Illinois at Urbana Champaign: Bulletin 4, Njala University College, University of Sierra Leone 1974, pp 89-97
[24] S.N. Nigam, R.Serraj, and M.J.V. Reddy "To compare efficiency of physiological trait-based and emperial selection approaches for drought tolerance in groundnut" Publishing company, Connecticut, USA 2004, pp 45-46
[25] S. Pande and N.J Rao "Resistance of wild Arachis species to late leaf spot and rust in green house trial". Plant Disease,2001, vol 85, pp 85-86
[26] Surgical critical care.net"Injury severity scoring". www.sugarcalcriticalcare.net/resources/injury 2001.
[27] W.R., Raun, J.Dhillon, L. Aula, E.Eickhoff, G.Weymeyer, B.Figueirdeo, T. Lynch, P. Omara, E. Nambi, F. Oyebiyi and A. Fornah."Unpredictable nature of environment on nitrogen supply and demand". *Agronomy Journal*, 2019, *111*(6), 2786-2791.
[28] W.Raun, B. Figueiredo, J.Dhillon, A. Fornah, J.Bushong, H. Zhang and R. Taylor "Can yield goals be predicted"?. *Agronomy Journal*, 2017, *109*(5), 2389-2395.