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Research Article

Evaluation of Irish Potato Genotypes (*Solanum tuberosum* L.) Against Diseases for Adaptability in Sierra Leone

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Abstract

Irish Potato is an emerging crop of high economic value in Sierra Leone. Cultivation of the crop is limited, and farmers are faced with numerous problems in the production of the crop. This research was done to identify diseases resistant adaptable sweet potato genotypes under Sierra Leone condition. Six Irish potato genotypes collected from the Futa Jalon highlands in Guinea were evaluated in Kabala and Njala during 2013 and 2014 cropping season. The experiment was laid out in a randomized complete block design with three replications. Data was collected on agronomic parameters as wells as pest and disease. Data was analyzed using analysis of variance. Mean comparison was done using least significant difference (LSD) at 5% probability. Findings revealed that Kabala exhibited higher field establishment rates compared to Moyamba, with Spunta, Arnova, Nicola, and Mandola displaying significantly higher establishment percentages. Similarly, Spunta consistently exhibited the largest leaf area, vine length and highest plant vigor scores across locations. While all genotypes were susceptible to Potato Virus Disease (PVD), bacterial blight, and late blight, Spunta displayed the highest resistance to these diseases. Variations in tuber number and weight per plant were observed, with Spunta (4.4 and 3.6 t/ha) and Mandola (3.5 t/ha) showing the highest yields at both locations respectively. Notably, Spunta consistently outperformed other genotypes in terms of yield across both locations. These findings underscore the importance of genotype selection tailored to local conditions and the need for disease management strategies to enhance potato production and food security in Sierra Leone. Further research focusing on breeding programs targeting disease resistance and yield optimization is warranted to address the productivity challenges faced by Irish potato cultivation in Sierra Leone.

Keywords

Irish Potato, Genotypes, Disease Resistance, Adaptability, Crop Improvement

1. Introduction

Irish potato *Solanum tuberosum*L, is native to South America [1]. The crop has recently been recognized as an emerging crop of high economic value for which the Sierra Loene Agricultural Research Institute (SLARI) through the Njala Agricutural Reserch Center (NARC) has is committed in the development of the Iish potato value chain [2]. Potato is a food crop that responds well to the cooler climatic temperature. The storage root of sweet potato possesses enough and of good quality carbohydrate and other useful nutrient that is important for human consumption and that is why its cultiva-

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tion is highly appreciated by most farmers. Sweet potato leaf is a nutrient rich vegetable that is used as feed for human and animal across many communities where it is grown [3-5]. In the urban areas the demand is steadily increasing as a fresh product and in the processed forms. Sierra Leone imported between 1,000–2,000 MT of Irish potatoes per year between 2007–2011 from Europe, North America, and Guinea [6]. Sales from neighboring country Guinea into the local market of Kabala as well as the urban markets have attracted the more youthful population and women into the cultivation of the crop in the highland of Kabala.

In Sierra Leone Irish potato yields are low, ranging between 2 and 4 MT/ha [7] and its production level is well below national requirements [2]. However, official statistics on production and consumption levels are not available for Irish potatoes, making it difficult to assess the size of the import gap. Sweet potato has great potential for the achievement of food security in Sierra Leone though this potential has not been exploited and the attempt for farmers to fully realize this potential have met serious constraints which have resulted to the failure of this crop [8]. Diseases such as Nematode, fungal, viruses and insect pests' infestation are the major yield limiting factors of sweet potato and this situation can lead to both field and post-harvest [9-11]. It has been observed that one of the major farmers constraints especially small-scale farmers in Sierra Leone for sweet potato production is the management of pests and diseases. Stunting, small narrowing, distorted edge and puckering, molting and vein clearing are the associated symptoms of sweet potato virus disease [10]. Planting diseased vine cuttings or storage roots are the greatest collective sources of sweet potato viral diseases. In as much as this could be threatening, vine cuttings from mature crops seem to be the easiest way of propagating the crop [12]. This leads to a higher rate of transmission of the virus diseases through infected propagules to newly planted fields. Disease control measures such as good farm sanitation, cultural practices, and proper control of vector populations to retard or prevent damage, have been postulated [13]. Nevertheless, the use of clean and healthy planting materials that are free of diseases has been reported as an effective, economical, and environmentally friendly approach to managing viral diseases in many crops [13, 14, 11]. In Sierra Leone as in the rest of Africa, limited availability of quality planting material at affordable prices, pests and disease attack and labour constraints has been the limiting factor for sweet potato cultivation [15, 16, 7]. There is limited information on Potato research in Sierra Leone. The evaluation of Irish potato against diseases for adaptation in Sierra Leone provides an opportunity generate more information on the production of potato in Sierra Leone. The focus of this study was to identify Irish potato genotypes that is resistant and adaptable in Sierra Leone. The aim of study is to identify adaptable and diseases resistant Irish potato genotypes with desirable agronomic traits and assess the incidence and severity of prevalent diseases of Irish potato in Sierra Leone.

2. Materials and Methods

2.1. Description of the Experimental Sites

This research was conducted during the 2013 and 2014 cropping seasons at SLARI on-station sites located at Kabala (9 °05'N, 11 °06'W and 464.2m), Koinadugu district and Njala (8 °10' N, 12 °08W and 51m), Moyamba district respectively. There are two distinct seasons; a rainy season from mid- April to mid-November when up to 95% of the rain falls; and a dry season from mid- November to mid – April.

The predominant vegetation in Kabala consists of forest savannah which consists of typical fire tolerant tree species and the dominant grasses are usually Andropogon spp. Total precipitation is suitably high and estimated to be 2216 – 3,000 mm. Average sunshine hours per day are 4.2 with variation of 0.4 to 3.2 hours between June and October. The mean temperature varies from 20 ℃ to 32 ℃.

Njala consists of dissected plains of low relief (common valley swamps) which are very gravely clay loam soil. The vegetation consists of a mosaic of savannah woodland re-growth thicket and scattered oil palm.

Total precipitation is suitably high and estimated to be 2216 – 3,000 mm. Average sunshine hours per day are 4.2 with variation of 0.4 to 3.2 hours between June and October. The mean temperature varies from 20 ℃ to 32 ℃.

2.2. Germplasm Collection

A total of eight irish potato genotypes (Arnova, Spunta, Mandola, El- Beida, Charmeuse, Nicola, Rubis and Faluka), sourced mostly from farmers'assocoation, were collected in 2013in the Futa Jalloh highlands (Labe and Mamou regions) of the Rebublic of Guinea (Figure 1). Mamou shares border with the Koinadugu district.

2.3. Experimental Design and Cultural Practices

The experimental design was a randomized complete block design with three replications. Six Irish potato genotypes (Arnova, Spunta, Mandola, Nicola, Rubis and Faluka) were randomly allocated to treatment plots within each block. The plot size for each treatment was 10.5 m^2 (3.5 m x 3 m).

The experimental sites were established in the lowland which has been properly cleared, ploughed, and levelled using traditional hoe and cutlass method. Sweet potato vines (30 cm in length were planted on ridges with plant spacing of 70 cm between rows and 30 cm between plants and weeding were done at the appropriate time.

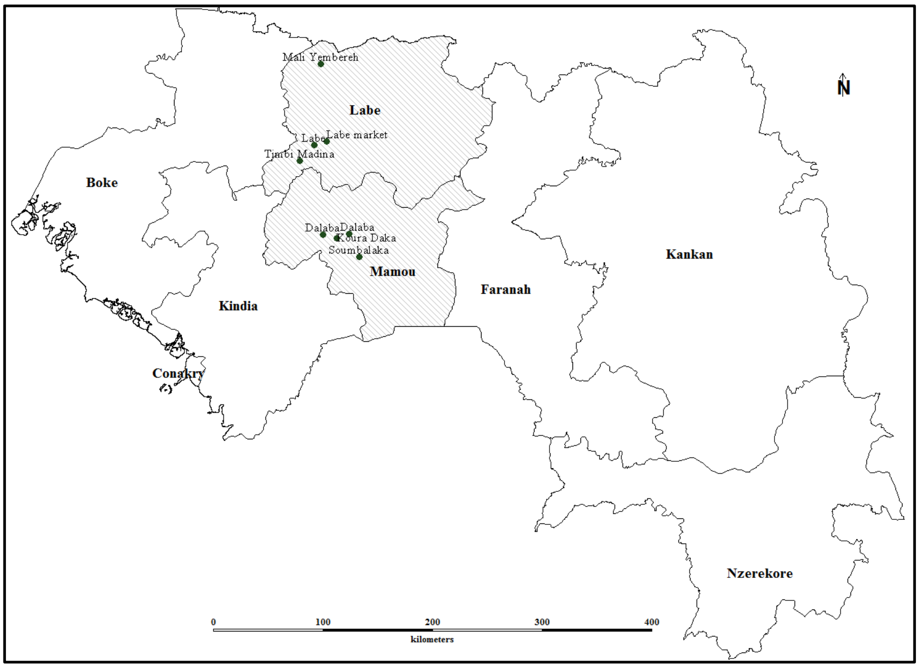

Figure 1. *Map of Guinea showing locations where irish potato germplasm where collected.*

2.4. Data Collection Procedure and Measurement Taken

Data on field establishment included percent sprout was collected one month after planting whereas vine length and leaf area were collected at 1, 2 and 3 months after plant.

Plant vigor assessment was done through visual assessment in the presence of disease. The parameters assessed for plant vigor include Shoot growth (the presence of many actively growing shoots is a good indication of excess vigor), length of internodes (long or short), and canopy gaps. The vigorous growth was scored using a modified 9-point scale according to Abidin *et al*. [17], where.

1= Underdeveloped vines, 2= Feeble vines and stems, elongated internodes distances, 3= Feeble to medium-strong vines, medium-thick stems, and elongated internodes distances, 4= medium-strong and thick stems with fair internode distances, 5= medium-strong and thick vines with elongated internodes distances, 6= medium-strong and thick stems with fair internode distances, 7= well-developed stems with short internode distances, 8= strong vines, thicker stems with shorter internode distance, 9= very strong and thicker stems, and shorter internode distances.

Visual assessment of the diseases was done at 1, 2, and 3 months after planting. The severity of diseases was assessed using color and size deviation of the leaf and vine and the 1- 3 scale adapted from Low, [18]. where 1 = no disease to 3 = severe disease, i.e with severe being defined as over 50% of the plot and leaf area showing the disease symptom or affected by the pest.

Yield parameters such as number of tubers, average tuber weight (g) and fresh yield weight (t/ha) were assessed at harvest.

2.5. Data Analysis

Data was analyzed using simple statistics. Analysis of variance (Anova) was used to compare means through the Genstat Discovery Edition 3 Statistical Software. Means were separated using LSD at 5% level of significance.

3. Results

3.1. Field Establishment and Growths Characteristics

The field establishment and percentage survival of Irish potato genotypes exhibited significant differences ($p \leq 0.05$) in both locations, with Kabala showing higher rates compared to Moyamba. In Kabala, Spunta (66.7%), Arnova (66.7%), Nicola (60.0%), and Mandola (55.6%) displayed significantly higher field establishment compared to other genotypes. Conversely, Rubis and Faluka exhibited the lowest field establishment rates at 3.33%. At Njala, Spunta (71.1%), Nicola (66.7%), and Mandola (65.2%) demonstrated the highest percentage survival, closely followed by Arnova at 57.8%. However, Rubis (26.7%) and Foluka (31.7%) recorded the lowest field establishment rates (Table 1).

The vine length of Irish potato genotypes exhibited significant differences ($p \leq 0.05$) in both locations. In Kabala, Spunta displayed the highest vine length at 162.7 cm, significantly surpassing Mandola at 150.3 cm. Arnova and Faluka exhibited vine lengths of 146.7 cm and 146.1 cm respectively, which were not significantly different from each other but were notably higher than Rubis, which recorded the shortest vine length at 101.9 cm (Table 2). Meanwhile, at Njala, significant differences ($p \leq 0.05$) were observed among genotypes in vine length, with Spunta exhibiting the highest vine length at 159.5 cm, followed by Mandola at 148.5 cm andicola at 146.7 cm. Rubis, Arnova, and Faluka displayed the shortest vine lengths at 140.2 cm, 140.0 cm, and 140.8 cm respectively. Notably, vine length was consistently higher at Kabala compared to Njala throughout the evaluation period (Table 1).

The leaf area of Irish potato genotypes displayed significant differences ($p \leq 0.05$) in both locations. In Kabala, Spunta exhibited the largest leaf area, significantly surpassing others at 156.1 cm^2, followed by Mandola at 146.8 cm^2 and Faluka at 141.6 cm^2, whereas the Rubis genotype recorded the smallest leaf area at 125.2 cm^2 (Table 1). Similarly, at Njala, Spunta also demonstrated the largest leaf area at 145.5 cm^2, closely followed by Mandola at 140.9 cm^2, while Rubis exhibited the smallest leaf area at 126.7 cm^2.

The visual assessment of plant vigor revealed significant differences ($p \leq 0.05$) among genotypes, with noticeable variations observed in plant vigor across different locations throughout the evaluation period. In Kabala, the highest plant vigor score of 8.5 was attributed to the Spunta genotype, followed by Mandola at 7.5 and Nicola at 7.1, while the lowest plant vigor score of 5.4 was recorded for Rubis. Conversely, at Njala, the highest plant vigor score was observed with Spunta at 7.8, followed by Mandola at 7.4 and Nicola at 7.2, with Rubis displaying the lowest plant vigor score of 6.3.

Table 1. *Field establishment and growth characteristics of Irish potato genotypes in Kabala and Njala.*

Variety	Field establishment (%)		Vine length (cm)		Leaf area (cm^2)		Plant vigor	
	Kabala	Njala	Kabala	Njala	Kabala	Njala	Kabala	Njala
Arnova	66.7±4.1^{a}	57.8±3.4^{b}	147.5±8.1^{b}	140.0±7.2^{c}	131.7±8.2^{c}	137.9±6.0^{c}	6.3±0.2^{b}	6.8±0.3^{b}
Faluka	33.3±2.1^{b}	31.7±2.3^{cd}	146.1±9.3^{bc}	140.8±6.3^{c}	141.4±8.4^{b}	136.3±6.7^{c}	6.8±0.3^{b}	6.8±0.4^{b}
Mandola	55.6±3.1^{a}	65.2±6.0^{ab}	150.3±9.0^{ab}	148.5±5.2^{ab}	146.8±8.2^{ab}	140.9±8.4^{b}	7.5±0.6^{a}	7.4±0.4^{a}
Nicola	60.0±3.2^{a}	66.7±5.1^{ab}	138.8±6.3^{c}	146.7±7.0^{b}	141.6±4.0^{b}	136.7±3.2^{c}	7.1±0.3^{a}	7.3±0.3^{a}
Rubis	33.3±3.0^{b}	26.7±1.9^{d}	101.9±5.1^{d}	140.2±4.2^{c}	125.2±4.3^{d}	126.5±6.1^{d}	5.4±0.2^{c}	6.3±0.2^{b}
Spunta	66.7±5.0^{a}	71.1 ±6.0^{a}	162.7±8.3^{a}	159.5±6.3^{a}	156.1±5.2^{a}	145.5±5.3^{a}	8.5±0.6^{a}	7.8±0.4^{a}
F test (P value)	<.001	<.001	0.02	0.05	<.001	0.03	0.05	0.05
LSD (P = 0.05)	13.5	11.33	11.37	14.6	3.39	13.5	2.5	2.1
CV (%)	14.2	13.8	6.9	6.9	26.2	19.8	12.4	10.1

Means with the same letter in each column are not significantly different according to the LSD test 0.05 level of probability.

3.2. Diseases Assessment

All potato genotypes evaluated at Kabala and Njala displayed susceptibility to Potato virus disease, with no significant variation observed in severity scores among genotypes ($p \geq 0.05$). At Kabala, the mean severity scores for Potato virus disease were moderate across genotypes, with Spunta exhibiting the lowest severity score of 1.5, which was identical to the severity score of Mandola (1.6). The highest severity score of 1.8 was recorded for Rubis, although not significantly different from the severity score of 1.7 observed for Faluka, Arnova, and Nicola. At Njala, the lowest severity score of 1.7 was noted for Spunta, followed by Mandola at 1.9. Conversely, the highest severity score of 2.6 was recorded for Rubis and Faluka (Table 4).

Visual assessments revealed the presence of bacterial blight disease across both locations, although there was no significant ($p \geq 0.05$). variation in disease severity among genotypes throughout the evaluation (Table 2). In Kabala, the mean severity score for bacterial blight was highest for Faluka and Rubis at 2.6, closely followed by Arnova at 2.4, while Spunta exhibited the lowest mean severity score of 2.0, followed by Mandola at 2.1. At Njala, the lowest severity score of 1.6 was recorded for Spunta, with Mandola and Nicola closely trailing at a severity score of 1.7 each. However, higher severity scores were recorded for Rubis at 2.2, closely followed by Faluka with a severity score of 2.1.

Late blight disease assessment revealed its presence across all plots in both locations. The infestation of late blight was observed to be notably high and did not display significant variation among the tested genotypes. In Kabala, Faluka and Rubis exhibited the highest severity scores of 2.6, followed by Arnova at 2.3. Conversely, Spunta exhibited the lowest severity scores of

2.0 (Table 4). Similarly, at Njala, Faluka and Rubis displayed the highest severity scores of 2.7, followed by Arnova at 2.0. The lowest severity score of 1.6 was recorded for Spunta, which was statistically comparable to the severity scores of 1.7 observed for Mandola and Nicola (Table 2).

Table 2. Disease assessment of Irish potato genotypes in Kabala and Njala.

Variety	Severity of potato Virus		Severity of bacteria blight		Severity of late blight	
	Kabala	Njala	Kabala	Njala	Kabala	Njala
Arnova	1.7±0.1[a]	2.6±0.0[a]	2.4±0.1[a]	1.8±0.0[a]	2.3±0.2[a]	2.0±0.0[a]
Faluka	1.7±0.0[a]	2.6±0.2a	2.6±0.2[a]	2.1±0.2[a]	2.6±0.1[a]	2.7±0.2[a]
Mandola	1.6±0.1[a]	1.9±0.0[a]	2.1±0.0[a]	1.7±0.0[a]	2.1±0.2[a]	1.7±0.2[a]
Nicola	1.7±0.1[a]	2.0±0.2[a]	2.2±0.2[a]	1.7±0.0[a]	2.2±0.0[a]	1.7±0.1[a]
Rubis	1.8±0.0[a]	2.6±0.2[a]	2.6±0.1[a]	2.2±0.2[a]	2.6±0.0[a]	2.7±0.2[a]
Spunta	1.5±0.1[a]	1.7±0.2[a]	2.0±0.1[a]	1.6±0.0[a]	2.0±0.2[a]	1.6±0.1[a]
F test (P value)	Ns	Ns	Ns	Ns	Ns	Ns
LSD (P = 0.05)	0.3	0.6	0.5	0.3	0.5	0.4
CV (%)	21.8	20.5	21.3	24.4	24.2	24.0

Means with the same letter in each column are not signioficantly different according to the LSD test 0.05 level of probability. Ns = no significant.

3.3. Yield and Yield Component

The quantity of tubers per plant among Irish potato genotypes exhibited significant differences ($p \leq 0.5$) in both locations. In Kabala, there was a notable variation in the number of tubers per plant across genotypes. Mandola and Spunta displayed the highest number of tubers per plant at (3.0 $plant^{-1}$) followed by Nicola at (2.6 $plant^{-1}$) which was statistically comparable to Arnova's 2.0 $plant^{-1}$). Conversely, Faluka and Rubies showcased the lowest number of tubers per plant at (1.3 and 1.6 $plant^{-1}$) respectively (Table 3). Similarly, at Njala, Mandola, Nicola, and Spunta recorded the highest number of tubers per plant at (2.3 $plant^{-1}$), though not significantly different from Faluka's (2.0 and Rubis's 1.7 $plant^{-1}$), both of which displayed the least number of tubers per plant (Table 3).

The average weight of tubers per plant among Irish potato genotypes displayed significant differences ($p \leq 0.5$) in both locations. In Kabala, Spunta exhibited the highest tuber weight per plant at 215.4 grams, closely followed by Mandola at 210.2 grams, and Nicola at 177.0 grams. Conversely, Rubis recorded the lowest tuber weight per plant at 137.9 grams. Similarly, at Njala, Spunta maintained its lead with a tuber weight per plant of 200.4 grams, followed by Mandola at 189.1 grams, and Nicola at 186.1 grams, while Rubis again displayed the least tuber weight per plant at 170.0 grams.

The fresh tuber yield of different Irish potato genotypes showed significant variations at both locations ($p \leq 0.05$). In Kabala, there were notable differences in yield estimates among genotypes. Spunta demonstrated the highest yield at 4.4 tons per hectare, followed closely by Mandola at 3.5 tons per hectare, with no significant difference between them. Conversely, the lowest yield per hectare, at 1.2 tons, was observed for Rubis and Faluk (Table 3). At Njala, Spunta and Mandola exhibited the highest yields, reaching 3.6 and 3.5 tons per hectare respectively, which were significantly different from Rubis's yield of 1.1 tons per hectare, the lowest recorded.

Table 3. Yield and yield components of Irish potato genotypes in Kabala and Njala.

Variety	Number of tubers per plant		Tuber weight per plant (g)		Fresh tuber yield (t ha^{-1})	
	Kabala	Njala	Kabala	Njala	Kabala	Njala
Arnova	2.0 ±0.1[ab]	2.1±0.1[a]	154.3±6.3[bc]	179.3±12.3[cd]	2.0±0.2[b]	3.3±0.3[a]

Variety	Number of tubers per plant		Tuber weight per plant (g)		Fresh tuber yield (t ha^{-1})	
	Kabala	Njala	Kabala	Njala	Kabala	Njala
Faluka	1.3 ±0.0^{c}	2.0 ±0.1^{a}	144.0 ±4.0^{c}	173.5 ±10.0^{cd}	1.2 ±0.0^{c}	2.0 ±0.0^{b}
Mandola	3.0 ±0.2^{a}	2.3 ±0.1^{a}	210.2 ±8.2^{b}	189.1 ±10.5^{b}	3.5 ±0.2^{a}	3.5 ±0.2^{a}
Nicola	2.6 ±0.2^{a}	2.3 ±0.1^{a}	177.0 ±9.0^{ab}	186.1 ±12.0^{ab}	3.0 ±0.3^{a}	3.4 ±0.3^{a}
Rubis	1.6 ±0.0^{bc}	1.7 ±0.1^{b}	137.9 ±6.6^{d}	170.0 ±10.0^{bc}	1.2 ±0.0^{c}	1.1 ±0.0^{c}
Spunta	3.0 ±0.2^{ab}	2.3 ±0.1^{a}	215.4 ±11.5^{a}	200.4 ±11.6^{a}	4.4 ±0.2^{a}	3.6 ±0.1^{a}
F test (P value)	0.02	0.05	<0.001	0.02	0.03	<.001
LSD (P = 0.05)	1.0	0.84	13.99	17.58	0.7	0.95
CV (%)	26.2	22.7	16.1	17.5	16.5	19.2

Means with the same letter in each column are not significantly different according to the LSD test 0.05 level of probability.

3.4. Correlation Analysis

Diseases, growth, and yield parameters were variably related to each other. There were positive correlations among agronomic traits namely plant Vigor, vine length, leaf area and yield. There was, however, negative correlation between diseases scores and agronomic traits. This means that as the disease's severity rises, plant vigor, vine length, leaf area and root yield reduce. Plant vigor positively correlated with vine length, leaf area and root yield. This means that an increase in plant vigor significantly improve plant growth and development as seen in vine length, leaf area and root yield. Similarly, vine length positively correlated with leaf area and root yield (Table 4).

Table 4. *Correlation between plant vigor (PV), vine length (VL), diseases score (DS) and root yield (RY).*

Variety	potato Virus				bacteria blight				Severity of late blight			
	PV	VL	DS	RY	PV	VL	DS	RY	PV	VL	DS	Yield
PV	----		-0.6**		----		-0.4*		----		-0.3*	
VL	0.7***	----	-0.3*		0.7***	----	-0.5**		0.7***	----	-0.3*	
DS			----	-0.6**				-0.31*				-0.5**
RY	0.6***	0.4*		----	0.6**	0.4*		----	0.6**	0.4*		----

*= significant at 0.05, **= significant at 0.01, *** =significant at 0.001

4. Discussion

The evaluation of Irish sweet potato genotypes against diseases in Sierra Leone is a crucial aspect of Agricultural research aimed at enhancing food security and livelihood as sweet potato is one of the staple food crops in Sierra Leone. The results obtained from the field experiments on six Irish potatoes conducted at Kabala and Njala location provide valuable insights into the performance of these genotypes in terms of field establishment, plant vigor, diseases resistance and yield parameters. The findings revealed differences in field establishment and survival rates among the genotypes indicating varying levels of adaptability to respective environments of Kabala and Njala. Genotypes such as Spunta, Arnova and Nicola exhibited higher field establishment percentages, suggesting their suitability for cultivation in these areas. The difference in field establishment among the Irish potato genotypes could be attributed to the variability of the genetic constitution of the crop. Results from Kabala were more favorable than Njala due to better enviromental conditions that favour the germination and establishment of the crop. This study supports the view of Seifu Fetena and Betewulign Eshetu, which states that adapting best suited genotypes in the environment for increasing production and productivity and resistant to disease was a best strategies and evaluation of genotypes for local adaptation should continue to part of strategic approach for Irish potato improvement in Sierra Leone [19].

Additionally, the significant differences in vine length and leaf area among genotypes highlight variations in growth and photosynthetic efficiency. Genotypes with longer vines and larger leaf areas, such as Mandola and Spunta, may have an advantage in terms of resource capture and utilization, and resistant potentially leading to higher yields. These traits could be targeted in breeding programs to enhance productivity and resource-use efficiency in potato cultivation. Furthermore, the assessment of plant vigor revealed significant differences among genotypes, with Spunta consistently exhibiting high vigor scores across locations. This is in consistent with the study of Gibson *et al*. [20], who reported a decrease in the general growth and development among sweet potato cultivars that are highly susceptible to diseases. The susceptibility of all potato genotypes to Potato virus disease highlights the importance of disease management strategies in potato production. While no significant variation was observed in disease severity among genotypes, Spunta was the most resistant genotype to potato virus disease. Gruneberg *et al*. [21] also reported a higher SPVD pressure among sweet potato cultivars that are susceptible to the disease. Similarly, the prevalence of bacterial blight and late blight diseases underscores the ongoing challenges posed by these pathogens in potato cultivation. Although no significant variation in disease severity was observed among genotypes, however, Spunta and Mandola were the genotypes that were somehow resistant against bacterial blight and late blight diseases. This result corroborates with that of Putri *et al*. [22] who reported a higher disease incidence and severity among genotypes in Ghana.

The significant differences in the number and weight of tubers per plant among genotypes reflect variations in tuberization and yield potential. Genotypes such as Spunta and Mandola exhibited higher tuber weights and yields, highlighting their potential for commercial cultivation. The current result is also in agreement with the reports of Stephan et al. [23] who also reported a noticeable variation among sweet potato varieties in terms of virus resistance and its influence on the quantity and quality of root and biomass yields among sweet potato varieties. The correlations observed among agronomic traits and disease scores provide insights into the complex interactions between plant growth, disease resistance, and yield potential. Positive correlations between plant vigor, vine length, leaf area, and yield suggest that enhancing vigor and vegetative growth could positively impact yield performance. Conversely, negative correlations between disease severity and agronomic traits underscore the detrimental effects of disease pressure on plant growth and productivity. This study confirms the work of Jone, [24] and Ngailo et al. [10] who reported that an increase in vegetative development increased photosynthetic ability of plants leading to higher production of photosynthates that could store in root.

5. Conclusions

The productivity of Irish potato genotypes in Sierra Leone remains suboptimal, with Spunta, Mandola, and Nicola exhibiting promising traits such as higher yields and greater survival rates under Sierra Leonean conditions. Kabala proved to be a more favourable environment for Irish potato cultivation compared to Njala. Nonetheless, the identified genotypes still demonstrated susceptibility to prevalent diseases. The assessment of Irish sweet potato genotypes in Sierra Leone offers critical insights into strategies aimed at bolstering food security and livelihoods. Field experiments conducted at Kabala and Njala unveiled substantial variances among genotypes concerning establishment rates, Vigor, disease resistance, and yield. The observed variability in establishment rates implies adaptability influenced by genetic factors, underscoring the necessity of meticulous genotype selection processes. Variations in vine length and leaf area suggest the potential for optimizing resource utilization and augmenting yields through targeted breeding endeavors. Evaluations of disease resistance unveiled diverse susceptibility levels, with Spunta exhibiting heightened resistance against Potato Virus Disease (PVD), bacterial blight, and late blight. The disparities in tuber count and weight per plant, particularly notable in genotypes like Spunta and Mandola, signify their viability for commercial cultivation.

Abbreviations

NARC	Njala Agricultural Research Center
SLARI	Sierra Leone Agricultural Research Institute
PVD	Potato Virus Disease
SPVD	Sweet Potato Virus Disease
PV	Plant Vigor
VL	Vine Length
DS	Diseases Score
RY	Root Yield

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Author Contributions

Alusaine Edward Samura: Conceptualization, Investigation, Methodology, Validation, Formal analysis, Writing draft, writing review and editing and resources.

Vandi Amara: Conceptualization, Investigation, Methodology, Validation, Formal analysis, Writing draft, Writing review and editing.

Fatmata Binta Samura: Validation, Editing and resources.

Conflicts of Interest

The authors declare no conflicts of interest.

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