Farmers' Perspectives on Occurrence and Management of Rust and Groundnut Leaf Spot Diseases in Different Agro-ecological Zones in Mtwara Region

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Abstract

Rust and leaf spot diseases are important constraints of groundnut (Arachis hypogaea L.) production in Mtwara. This study aimed at establishing farmers' viewpoint on occurrence and management measures against foliar fungal diseases in coastal zone (CZ) and eastern plateaux and mountain block zone (EPMBZ) of the Mtwara region. Random and purposive sampling methods were employed and a 200 farmers sample size was used. Semi-structured questionnaire was administered. About 100 farms were selected and, a square quadrat was used whereby in each square, 5 plants were assessed for disease severity and incidence. Early leaf spots (ELS) had the highest incidence (93%) and severity (49%) followed by rust (79% incidence and 35% severity). The lowest incidences and severity were observed for late leaf spot (LLS) as 71% and 30%, respectively. There was a significant difference between the farmers awareness on the fungal diseases in the two zones were significantly varied (df = 198, p = 0.033) Farmers in the CZ were more aware of rust and late leaf spot diseases than those in EPMBZ. The majority of farmers in the CZ adopted appropriate disease management measures especially the removal of volunteer plants (94%) and use of conventional tillage (29%), respectively, to reduce disease inoculum from the soil surface. The study concludes that farmers in Mtwara region differentially understand the fungal foliar diseases. The occurrence and severity of rust, ELS and LLS varied between locations suggesting there is environmental influence. Meanwhile, farmers in CZ and EPMBZ employed different disease management agricultural practices that they did not employ/adopt the use of chemical fungicides. The study recommend intercropping groundnuts with tubers and legumes, usage of certified seeds, management of crop residues, removal of volunteer plants before sowing and conventional tillage as means of rust and leaf spot diseases management options to increase groundnut yield in the Mtwara region.

Keywords: groundnut*, Puccinia arachidis, Cercospora arachidicola, Cercosporidium personatum,* rust, leaf spot

Introduction

Groundnut (*Arachis hypogaea* L.) is an annual legume crop, which is mainly grown for the oilseed, food, and animal feeds. In Tanzania, the production of groundnuts is mostly done by smallholder farmers. Groundnut productivity in Tanzania is low (909.2 kgha^{-1}) compared with global average (1,685.6 kgha^{-1}) productivity (Mwatawala and Kyaruzi, 2019). Mtwara region is one of the major groundnut producers in Tanzania (Katundu *et al.,* 2014) but the average productivity (650 kgha^{-1}) is low (PMO and RALG, 2012). The low yield in Mtwara can partly be due to the occurrence of both early and late leaf spots diseases. The two diseases are common groundnut fields in the Mtwara. The incidence and severity of each disease may vary between localities and seasons depending on prevailing environmental conditions (Waliyar *et al.,* 2000).

The role of environmental conditions on disease occurrence and severity is reported by various authors. Daudi *et al.* (2018) found that rust epidemics are favoured by continuous high temperatures (>22°C), along with wet weather or high humidity (>78%). Also, the development and dispersal of both Cercospora arachidicola and Cercosporidium personatum conidia are most prevalent in temperatures ranging from 16°C - 30°C and relative humidity exceeding 90% (Burns, 2010). However, resistant genotypes lessen the leaf spot diseases by making smaller lesions as a result of host-pathogen incompatible reaction, longer latent periods, and reduced sporulation of fungi (Tshilenge-Lukanda *et al.* 2012). Either, groundnuts varieties with resistance to leaf spot are characterized by relative late maturity (Ibid.). Ramanatha and Mcdonald (1989) reported that the evolution of new and more virulent groundnuts rust and leaf spot races of the pathogen can be counter-balanced by the development of high levels of resistance trait in the host system due to selection pressure during coevolution. Pathogen virulence has been shown to differ between locations (Gremillion, 2007). Pal *et al.* (2014) suggested the management of groundnut foliar diseases by intercropping with cereals like pearl millet or sorghum to reduce the intensity of leaf spot diseases. The same author reported that crop rotation involving cereal–cereal–groundnut helped to manage the late leaf spot diseases. This is because crop rotation provides a time period for the degradation of crop debris, which in turn deprives any surviving inoculum of host tissues. Apart from intercropping and crop rotations, tillage is known to create a soil layer (physical barrier) preventing fungal inoculum from coming into contact with new growing plants (Burns, 2010). Tillage works so because *C. arachidicola* and *C. personatum* are necrophilic and survive from season to season on crop debris.

According to Daudi *et al.* (2018) farmers possess valuable knowledge and can contribute to agricultural research and development. The farmers do acquire information from a member of his or her own group. This farmer to farmer flow of information can increase the adoption of new disease management practices including improved varieties (Banla *et al.,* 2018). According to Mwalongo *et al.* (2020) improved groundnut varieties have higher productivity than non-improved varieties. Farmers' knowledge of groundnut's resistance to rust and leaf spot diseases play a key role in their decision to adopt improved groundnut varieties and other management options (Daudi *et al.,* 2018). The current study determined farmers' awareness on the occurrence of rust and groundnut leaf spot diseases, and establishes the agricultural practices that are commonly used by farmers to manage rust and leaf spot diseases in CZ and EPMBZ.

Material and Methods

Description of the study site

The study was conducted in two Agro-ecological Zones (AEZs) of the Mtwara region, which are the Coastal Zone (CZ) and the Eastern plateaux and mountain block zone (EPMBZ). The two zones are defined on the basis of climate, soil type and elevation. The survey was conducted in five wards of each of the two zones; CZ (Nanhyanga, Kitama, Mahuta, Mkwiti and Ngunja) and EPMBZ (Mikangaula, Mangaka, Chipuputa, Likokona and Napacho). The EPMBZ is located between 38o and 39 o while CZ is located between 39 o and 40 o East of Greenwich. The region is located between 10 o and 11 o south of the Equator (U.R.T, 2019). The CZ is characterized by plains with slight hills, sandy and loamy soil, altitude less than 500 m.a.s.l and annual rainfall of 500 -1000mm. The EPMBZ is characterized by plains with medium hills, loamy and clay altitude of 200 - 500 m.a.s.l. and annual rainfall of 800 -1000mm.

Sampling design

Purposive sampling was applied to select groundnut growers based on criteria of experience of at least five years of growing groundnuts. Simple random sampling was used to obtain a sample of groundnut growers with a balanced representation of gender groups of both Coastal and Eastern plateaux and mountain block zones. Sample size was determined based on Fisher *et al,* (1991).

In each ward semi-structured questionnaires were administered to the selected groundnuts farmers to collect data on the gender, age, farm size, experience in growing groundnuts, usage of certified seeds, groundnut productivity, awareness of rust and leaf spot diseases, groundnut varieties used, fungicide usage, removal of volunteer plants, mixed cropping, management of crop residues and crop rotation (Denscombe, 2014; Manandhar *et al.,* 2016). The number of fields assessed with the rust and leaf spot diseases was recorded to determine the distribution of the diseases in each ward. Respondents were met at their homes and were asked for their consent to participate in the study.

Occurrence of groundnuts rust and leaf spot diseases

In each of the 10 farms, a quadrat was thrown at starting point for each field and walked in a zig-zag path from one end of the plot to the other covering the whole groundnuts field, crossing different rows and avoiding the edge. From each quadrat throw, 5 plants were assessed for disease severity and incidence. Groundnuts rust and leaf spot diseases severity were determined as per Gaikpa *et al.* (2015) rating scale. Disease severity was rated using modified score scale of 1 to 9 whereby foliar infection area was rated as 1 = 0%; 2 = 1–5%; 3 = 6–10%; 4 = 11–20%, 5 = 21-30%; 6 =31–40%; 7 = 41–60%, 8 = 61–80% and 9 = 81–100% of foliar area infection with plants having almost all leaves defoliated leaving bare stems. For leaf spot disease, the variety with scores 4-6 ware moderately resistant (MR) and 7 was designated as susceptible. For leaf rust diseases, test plants were categorized as resistant (score of <3), moderately resistant (MR) (score of 4 and 5), susceptible, (score of 6 and 7) and highly susceptible (HR) (score of 8 and 9) Sudini *et al.,* 2015).

Farmers awareness level to groundnut rust and leaf spot was examined based on 0 – 100% scores, whereby 20-49% were categorized as low than 50% and above as high (Neindow *et al.,* 2018) whereby seven questions in the questionnaire related with diseases symptoms were used in the evaluation. A questionnaire guided the respondents on to list practices adopted in disease management (choice of variety, management of crop residues, and removal of volunteer plants, rotating crop rotation, usage of fungicides and mixed cropping).

Data Processing and Analysis

Disease incidences were determined by dividing the number of infected plants over the total number of sampled plants per quadrat times 100%.

$$Disease\ incidence = \frac{Infected\ plants}{Total\ number\ of\ plants} \times 100 \quad (1)$$

$$Disease\ severity = \sum \frac{\sum (n \times V)}{9 \times N} \times 100 \quad (2)$$

where n = number of plants within each infection score, V = numerical values of infection scores, N = total number of plants examined, and 9 is a constant and the highest score value.

The collected and calculated data were subjected to statistical analysis using the Statistical Package for Social Sciences software (IBM SPSS Statistics 25). Both quantitative and qualitative data were coded. Data on disease incidences and severity indices were tested for its dispersion using Coefficient of variation, and then transformed using the Arcsine transformation, in order to ensure homogeneity of the variance and normal distribution of the data. The transformed data were subjected to analysis of variance (ANOVA) and means separated by the least significant difference method at 5% level of probability. A t-test was used to compare results between two locations before they are summarized into figures and graphs. Disease prevalence in the two agro-ecological zones was analyzed using GenStat software 15th edition.

Results

Farm size and productivity

Results in Table 1, shows that there were significant differences (t = 7.013, df = 198, p <0.001) in farm size and groundnut productivity between the two agro-ecological zones in EPMBZ, the farmers had relatively large farm size (1.3±0.068ha) compared to those in the CZ (0.67±0.059ha). Also, the groundnut productivity during the 2017/18 cropping season was higher in EPMBZ (0.60±0.51t/ha) compared to the groundnuts productivity in the CZ (0.36±0.036t/ha). This is because in the subsequent season groundnuts productivity in 2018/19 were relatively higher in EPMBZ (0.48 ±0.044t/ha), compared to CZ (0.25±0.028t/ha).

Table 1 Farmer farm size and productivity in two agro-ecological zones of Mtwara region.

Variables	Agro-ecological zone	Means	Standard deviation	t	p
Farm size(ha)	Eastern plateaux and mountain block zone	1.30	0.07	7.013	<0.001
	Coastal zone	0.67	0.06		
Groundnut's productivity (t/ha) 2017/18	Eastern plateaux and mountain block zone	0.60	0.51	3.868	<0.001
	Coastal zone	0.36	0.37		
Groundnut's productivity (t/ha) 2018/19	Eastern plateaux and mountain block zone	0.48	0.44	4.387	<0.001
	Coastal zone	0.25	0.29		

Significant differences (t = 4.729, df = 198, p<0.001) were observed in the awareness level (%) of rust disease between the two zones. Eastern plateaux and mountain blocks had lower mean scores (23±2.51%) compared to farmers in the coastal zone (38.5±2.12%). No significant differences in farmer awareness of ELS and LLS were noted between EPMBZ and CZ (Table 2)

ELS and LLS disease incidence and severity

The result in Table 3, shows that there were highly significant (df = 90, P<0.001) differences between the two AEZs in incidences and severities of both early leaf spot (ELS), late leaf spot (LLS) and rust diseases. The ELS and rust disease incidence in the EPMBZ exceeded those in the CZ by 10 and 17% respectively. Similarly ELS and rust disease severity in the EPMBZ exceeded those in the CZ by 13 and 11% respectively. On the other hand the LLS disease incidence and severity in the CZ exceeded those in the EPMBZ by 22 and 14% respectively.

Table 2: Farmer's awareness on foliar fungal diseases affecting groundnut's productivity in two agro-ecological zones of Mtwara region

Variable	Agro-ecological zones	Means (%)	Standard deviation	t	p
Awareness to:					
ELS disease	Eastern plateaux and mountain block zone	28.29	23.382	-0.247	0.806
	Coastal zone	27.67	9.262		
LLS disease	Eastern plateaux and mountain block zone	24.97	23.615	0.929	0.354
	Coastal zone	27.34	9.650		
Rust disease	Eastern plateaux and mountain block zone	23.0	21.148	4.729	<0.001
	Coastal zone	38.5	25.045		

Table 3: Incidence and severity of groundnuts foliar diseases two agro-ecological zones of Mtwara region

Agro-ecological zone	Disease incidence (%)			Disease severity (%)		
	ELS	LLS	RUST	ELS	LLS	RUST
Eastern plateaux and Mountain block	98	60	87	56	23	40
Coastal	88	82	70	43	37	29
SE±	0.013	0.021	0.02	0.018	0.023	0.02
CV%	9.6	17.7	16.5	18.7	31.4	25.1
L.s.d	0.036	0.058	0.057	0.051	0.064	0.056
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Key: *SE± = Standard error of means, CV% = Coefficient of variation (%), L.s.d = least significance difference, ELS = Early leaf spot and LLS = Late leaf spot.*

In the two agro-ecological zones, the number of groundnut farmers who adopted the different agricultural practices as measures to manage rust, ELS and LLS diseases in groundnut fields varied significantly ($t = 2.485$, $df = 198$, $p<0.01$). The results in Table 4, show that farmers intercropped groundnuts with tubers. Great close to 50% of farmers in EPMBZ intercropped groundnuts with tubers while only one third practiced the same in the Coastal Zone (31±0.046%). The percentage of groundnut's farmers who intercropped groundnuts with legumes exceeded the percentage of farmers doing the same in the Coastal zone by 41%.

Table 4: Agricultural practices used for management of groundnut rust and leaf spot diseases in Mtwara agro-ecological zones

Variables	Agro-ecological zone	Means (%)	Standard deviation	t	p
Intercropping with Tubers	Eastern plateaux and mountain block zone	48	0.502	2.485	0.014
	Coastal zone	31	0.465		
Intercropping with legumes	Eastern plateaux and mountain block zone	46	0.501	7.499	<0.001
	Coastal zone	5	0.2194		
Removal of Volunteer plants before sowing	Eastern plateaux and mountain block zone	8	0.273	-3.952	<0.001
	Coastal zone	29	0.456		
Conventional tillage system					
	Eastern plateaux and mountain block zone	78	0.416	-3.334	0.001
	Coastal zone	94	0.239		
Usage of certified seeds	Eastern plateaux and mountain block zone	95	0.219	8.963	<0.001
	Coastal zone	46	0.501		
Residue control	Eastern plateaux and mountain block zone	30	0.461	3.867	<0.001
	Coastal zone	9	0.288		

The number of farmers practicing removal of volunteer plants in groundnuts fields of EPMBZ was lower than the number of farmers in the Coastal zone by 21%. While eight in ten farmers of EPMBZ practiced conventional tillage, nine in ten farmers of CZ used conventional tillage as one of the disease management measures. Correspondingly higher proportion of farmers reported using farm-saved certified seeds in EPMBZ (95 ±0.022%), compared to those in the CZ (46±0.05%). Higher proportional of farmers in the EPMBZ (30±0.046%) and CZ (9±0.029%) managed the diseases using the management of crop residues through burying or removing off the field.

Farmer's perceptions on groundnuts varieties' level of resistance to leaf spot and rust diseases

The study found that there was a significant (df = 99, $p<0.005$) difference between zones in the farmer's perception of the groundnut's resistance to the rust and leaf spot diseases. In the Eastern plateaux and mountain block zone, Naliendele and Johari were perceived by the majority (9 and 36%, respectively) of respondents as resistant to leaf spot; these two varieties were also reported by the majority (10 and 34%) as resistant to rust disease while Pendo, Nyota and Mnanje as susceptible varieties to rust and leaf spot diseases. Similarly there was a significant (df = 99, $p<0.005$) difference between agro-ecological zones in the perception of farmers regarding groundnut's resistance against rust and leaf spot diseases in the Coastal zone using one-sample statistics. Pendo, Mnanje, Serena ndogo and Serena kubwa were perceived by the majority (38, 6, 44 and 15%, respectively) of respondents as resistant to leaf spot disease. Pendo and Mnanje were perceived by the majority (37 and 8%, respectively) as resistant to rust disease while Serena ndogo and Serena kubwa were considered susceptible varieties to the same disease.

Discussion

Farm size and productivity

Cultivated land size is a good indicator of the importance of the crop in a particular area or community. This study established that area under groundnuts was relatively larger in the EPMBZ. This may be explaining the higher groundnut production (60 tons/year) in EPMBZ than the CZ. Chirwa *et al.* (2015), reported that farm size is among the factors that influence the decisions of smallholder farmers to adopt agricultural innovations for crop protection and choice varieties for high yield. According to Neindow *et al.* (2018), smallholder groundnuts farmers seldom apply crop rotation, burning and burying of crop residues after harvest and removal of volunteer groundnuts. In both two years, 2017/18 and 2018/19, groundnuts productivity was relatively lower in CZ. Lower yield in CZ could be associated with the predominance of late LLS, these results correspond to the study by Banla *et al.* (2018) their study revealed that late leaf spot disease is of economic importance among other groundnuts foliar disease.

Farmer awareness of diseases affecting groundnuts

The study has established that the proportion of farmers who were able to identify plants diseases with groundnut rust and LLS was higher in the CZ than in EPMBZ. However, the farmers in CZ had a shortage of knowledge on diseases management strategies. According to Banla *et al.* (2018), farmers' knowledge of the LLS disease helps them to determine the management strategies of late leaf spot.

Disease incidence and severity

Groundnuts foliar leaf spots were found in all two agro-ecological zones. However, rust and early leaf spot diseases were predominantly occurring in EPMBZ while late leaf spot disease was mainly in CZ. The high prevalence of rust disease in the EPMBZ could be attributed to the low management of volunteer plants. Volunteer plants become alternative hosts of pathogens especially *Puccinia arachidis* which can only perpetuate on volunteers plants. This is very common in area with mono-modal rain fed cropping (Muimba-Kankolongo, 2018).

In addition, the high incidence and severity of rust in EPMBZ can be ascribed to pathogens' ability to travel long distance across boarders by wind from infected fields (Power, 2014). This becomes a problem especially to crops which are sown later in EPMBZ.

Similarly, higher prevalence of early leaf spot in EPMBZ may be attributed to poor management of volunteer plant and zero tillage practices adopted by majority of farmers. Zero tillage retains residues from previous crop that are hosts of *Cercospora arachidicola* during overwintering as saprophytes to provide initial inoculum for next crop (Burns, 2010)

Occurrence of late leaf spot disease was abundant in coastal zone. The occurrence could be associated with limited adoption of cultural practices that can minimize disease pressure in the coastal zone. For example, according to Boudreau *et al.* (2016) mixed cropping practice would minimize airborne diseases by interrupting the movement of the pathogen from one host plant to another. While this works well with *C. arachidicola*, intercropping efficacy over *C. personatum* is low because the conidia are able to survive and disperse over long distances hence overcome the suppressive effects of intercrops on pathogen. The low adoptability to cultural practices that minimize disease pressure and the nature of *C. personatum* may the reason for the high LLS occurrence in coastal zone. In contrast the lower occurrences of late leaf spot disease in EPMBZ may be associated with high adoption of cultural practices that minimize the disease pressure.

According to Tenga *et al.* (2018) the coastal zone has higher temperature (26°C) compared to EPMBZ (24°C). According to Fulmer (2017), LLS pathogen had higher (60%) germination at 28°C, compared to ELS pathogens which are reduced to 40% germination at 28°C. This may be explaining the high occurrence of LLS in the Coastal zone. According to Panda (2015) groundnut rust and leaf spot disease epidemic is associated with weather condition of cropped area. Alternatively, the virulence potential of the pathogen varies with the races. Damicone, 2014) reported that *Cercospora arachidicola* isolates are less virulent than the *Cercosporidium personatum* which are the most destructive. Groundnut rust and leaf spot diseases severity varied among the agro-ecological zones this may be inherent cultivar's level of resistance. According to Muhammad and Bdliya, (2011) groundnut varieties with inherent susceptibility to leaf spot pathogens attack show severe symptoms. Gaikpa *et al.* (2017) reported that leaf spots disease severity (lesion diameters) was relative higher in the susceptible cultivars. Similarly Chaudhari *et al.* (2019) reported that disease pressure of LLS and rust across individual environments varied with groundnut genotype influence.

Diseases management practices

This study has revealed that farmers in the EPMBZ practiced mixed cropping practice which is one of the disease management measures of fungal foliar diseases of groundnuts. This argument is in line with Kumar and Thirumalaisamy (2016) who reported that intercropping groundnuts with sorghum, pigeon pea, and maize are beneficial for the management of groundnut's rust, early and late leaf spots diseases. Intercropping decreases diseases occurrences by making barriers to the pathogens dispersal from infected host to healthy crops. Various authors have associated low ELS and LLS disease incidences and severity with intercropping systems (Neindow *et al.,* 2018; Boudreau *et al.* 2016 and Yussif *et al.,* 2014).

Majority of the farmers in the coastal zone adopted conventional tillage. However, conventional tillage alone wouldn't minimize late leaf spot disease pressure without adoption of other cultural management practices such as burning of crop residues. According to Burns (2010) *C. arachidicola* and *C. personatum* are necrophilic and flourishing on the dead cells and tissues of the host from season to season. Therefore, conventional tillage create a soil layer (physical barrier) that prevent fungal inoculum from coming into contact with newly growing plant. This is possibly the reason that Kumar and Thirumalaisamy (2016) found that rust and leaf spot diseases can be effectively managed by deep burying of crop residues.

Burying, removal or burning crop residues is recommended because these residues favor the overwintering of rust and leaf spot pathogens. After overwintering they become the potential initial source of inoculum in the coming season (Desmae and Sones, 2017). Poor management of groundnuts residues on the field by the majority of the farmers in the coastal zone could be associated with higher foliar disease pressure in this zone. Destruction of crop debris by burning, deep burying and conventional tillage are basis for managing leaf spots and rust disease (Gremillion, 2007). Majority of farmers burn groundnuts residues in Eastern plateaux and mountain block zone, this could be associated with reduced fungal disease occurrence hence high groundnuts productivity in the agro ecological zone.

Choice of variety and planting high quality seed is another disease management option. Majority of groundnuts farmers in both agro ecologies use saved seeds for longer period beyond recommendation. According to Jelliffe (2020), groundnuts are open pollinated (about 99%) and seed saving is effective for up to 10 production cycles. Recycling seeds beyond this recommendation could be attributed to yield losses due to inferior performance of the varieties resulting from increased vulnerability and reduced seedling vigor (Ngwira *et al.,* 2020). The vigor of the initial seeds decline due to inbreeding with time, hence demanding replacement of the genetically pure seed stock (Ntare *et al,* 2008). To counteract these effects, studies have recommended that the variety replacement period of groundnuts is 6–8 years post release. Desmae and Sones (2017) reported that in case the farmers intend to save their own seeds for 2-3 years after receiving initial stock of improved varieties. Field inspection should be conducted to remove any abnormal looking plants while the crop is growing (Desmae and Sones, 2017). This practice helps in maintaining the genetic purity and health of the variety being grown. According to Monyo and Varshney (2016), the low adoption of available new varieties is mainly attributed to the underdeveloped and inadequate seed systems, shortage of quality seed and lack of timely delivery and awareness.

Adoption of groundnuts cultivars that are resistant to rust and leaf spot are effective in decreasing the production costs and improving production quality. Majority of farmers in EPMBZ obtained thorough informal seed supply system. The use of certified seeds in this region can be a reason for the low occurrence of late leaf spot disease in EPMBZ compared to coastal zone where majority cultivate none certified (Serena ndogo and Serena kubwa) varieties. Low adoption of certified verities could be associated with low affordability because they are normally sold high prices (Akpo *et al.,* 2020). Apart from price, the unavailability of the seeds in the production area could be another reason for the observed low utilization of certified seeds (Pande *et al.,* 2001).

Host resistance is an important aspect of managing groundnut fungal foliar diseases. Cultivating disease resistant cultivars would be the most effective, sustainable and cost-effective strategy in groundnut fungal foliar disease management. In this study, farmers demonstrated different perceptions on varietal resistance to rust, ELS and LLS. In the EPMBZ, the Johari variety was perceived as most resistant to rust and leaf spot diseases while Nyota variety as most susceptible. The observation may be ascribed to that the Nyota variety was released earlier in 1983 hence higher possibilities of having lost its purity because farmers used farm saved seeds and Johari released later in 1985. Also such long time recycling could have caused genetic dilution leading to loss of genetic fitness to disease resistance (Sujay *et al.,* 2012). Mwalongo *et al.* (2020) reported that about 81% of the groundnut producers in Tanzania still use old varieties, which are less resistant to foliar diseases though new varieties were available. Only few groundnut growers used Naliendele and Mnanje varieties probably because it is one of the recently (2009) released varieties and many farmers might not be aware of the variety and its potential to increase yield. Another reason could be that the improved varieties are not yet made adequately available within farmsteads. Pendo variety released in 1998 is reported to be the most cultivated variety in this zone. In the EPMBZ majority of farmers perceived Naliendele and Johari as resistant to rust and leaf spot diseases respectively comparable to the coastal zone. Pendo, Mnanje, Serena ndogo and Serena kubwa were perceived by majority as resistant to the leaf spot diseases then Pendo and Mnanje varieties as resistant to rust disease.

Conclusion

The study revealed that majority of groundnut farmers had inadequate knowledge on the fungal foliar diseases affecting groundnuts fields. Farmers in the Coastal zone had relatively higher awareness to rust disease compared to those in the EPMBZ. Groundnut rust and leaf spot disease occurrences were observed in all agro-ecologies. However rust and ELS were predominant in the EPMBZ while LLS was largely in the Coastal zone. Groundnut farmers in all two zones adopted management options to control diseases. These practices include intercropping groundnuts with tubers and legumes, usage of certified seeds and management of crop residues used by the majority EPMBZ. Removal of volunteer plants before sowing and conventional tillage were adopted by the majority of the farmers in the Coastal zone. Dissemination of knowledge on rust and leaf spot diseases management to the farmers would be the best option toward improved groundnuts productivity in Mtwara region.

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