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Research Application Summary

Occurrence of fungal and bacterial diseases of common bean (*Phaseolus vulgaris*) in western Kenya

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Abstract

Bacterial and fungal diseases of common bean (*Phaseolus vulgaris*) are a major constraint in production of the crop in western Kenya. The objective of this study was to determine the occurrence of fungal and bacterial diseases of common bean in diverse agro-ecological zones of western Kenya. A total of 635 farms were sampled in all the agro ecological zones. The major diseases affecting the common bean were common bacterial blight and root rots. Prevalence of fungal and bacterial diseases significantly ($P \leq 0.05$) varied with region and agro-ecological zone (AEZ). The high occurrence of fungal and bacterial diseases of common bean in western Kenya could be attributed to poor cropping practices and favourable weather conditions. The variation in disease prevalence and indices among the different agro-ecological zones can be used to identify bean varieties that are best suited for production in specific zones.

Key words: Agro-ecological zones, common bacterial blight, common bean, cropping practices, Kenya, root rots

Résumé

Les maladies bactériennes et fongiques du haricot commun (Phaseolus vulgaris) constituent une contrainte majeure à la production de la plante dans l'Ouest du Kenya. L'objectif de cette étude était de déterminer l'occurrence des maladies fongiques et bactériennes du haricot commun dans diverses zones agro-écologiques de l'Ouest du Kenya. Au total, 635 exploitations ont été échantillonnées dans toutes les zones agro-écologiques. Les principales maladies affectant le haricot commun étaient la brûlure bactérienne commune et la pourriture des racines. La prévalence des maladies fongiques et bactériennes variait significativement ($P \leq 0{,}05$) selon la région et la zone agro-écologique (AEZ). La forte occurrence de maladies fongiques et bactériennes du haricot commun dans l'Ouest du Kenya pourrait être attribuée à des mauvaises pratiques culturales et à des conditions météorologiques favorables. La variation de la prévalence et des indices des maladies entre les différentes zones agro-écologiques peut être utilisée pour identifier les variétés de haricot les mieux adaptées à la production dans des zones spécifiques.

Mots clés: Zones agro-écologiques, brûlure bactérienne commune, haricot commun, pratiques culturales, Kenya, pourriture des racines

Introduction

Western Kenya is considered one of the food basket regions of Kenya. One of the important crops produced in the region is common bean (*Phaseolus vulgaris*). Common bean has great potential for improving the productivity and livelihoods of Western Kenya small holder systems. This however, may not be fully exploited due to a variety of production constraints. These include diseases, low soil fertility, insect pests, low potential of cultivated varieties and variable rainfall (Katungi *et al.,* 2009). These factors also constrain the production of other major grain legumes in Kenya and other parts of the eastern Africa highlands. To restore the productivity of the region, measures to combat major common bean diseases must be put in place. This study was therefore carried out to determine the occurrence of fungal and bacterial diseases of common bean in diverse agro-ecological zones of western Kenya.

Materials and Methods

Six agro ecological zones were surveyed. They included the Lower Midland Zone 1, Lower Midland Zone 2, Lower Midland Zone 3, Lower Midland Zone 4, Upper Midland Zone 1 and Lower highland zone 1. Diseases affecting the common bean were identified based on symptoms. Surveyed crops were assessed for disease distribution, incidence and severity. Distribution was determined on a scale of 0 – 2 where: 0 = no disease, where 1 = spots and 2 = whole field infected. Disease incidence was determined as the number of infected plants over the total number of plants within 1 m^2 quadrats. Disease severity was assessed on a scale of 0 – 3 where: 0 = no disease; 1 = mild; 2 = moderate and 3 = severe. The same procedure was repeated for three more randomly selected sampling points on the same farm, a minimum of five meters apart. Disease indices were calculated by summing up the scores of distribution, incidence and severity. The study was done in the short rains of 2012 and repeated in the long rains of 2013.

Results

In both seasons, most of legumes in the study area were affected by foliar and root rot pests and diseases. Many of these diseases were seed borne. This could be due to recycling of farm saved seed for planting that are saved from previous harvest, borrowed from neighbours or purchased from local markets (Coyne *et al.,* 2003; Opole *et al.,*2003) which contribute greatly to the occurrence of bacterial and fungal diseases since most of these bean diseases are seed borne (Rubyogo *et al.,* 2007).

Several diseases were identified on common beans during the study in all the regions. The most common diseases affecting beans in all the regions were: common bacterial blight, angular leaf spot, root rot, rust, Ascochyta leaf spot, anthracnose and web blight. However, downy mildew, leaf rust and powdery mildew were observed in certain regions. Common bacterial blight, angular leaf spot and root rot had the highest overall mean disease intensity (Table 1; Figure 1) while web blight (2%) and anthracnose (6%) had the least overall disease

intensity in all the regions and agro ecological zones under study. The highest total disease indice (39.3%) for all the disease affecting common bean was recorded in LM2 (Rangwe region) while the lowest (26.7%) was recorded in LM4 in Bondo region.

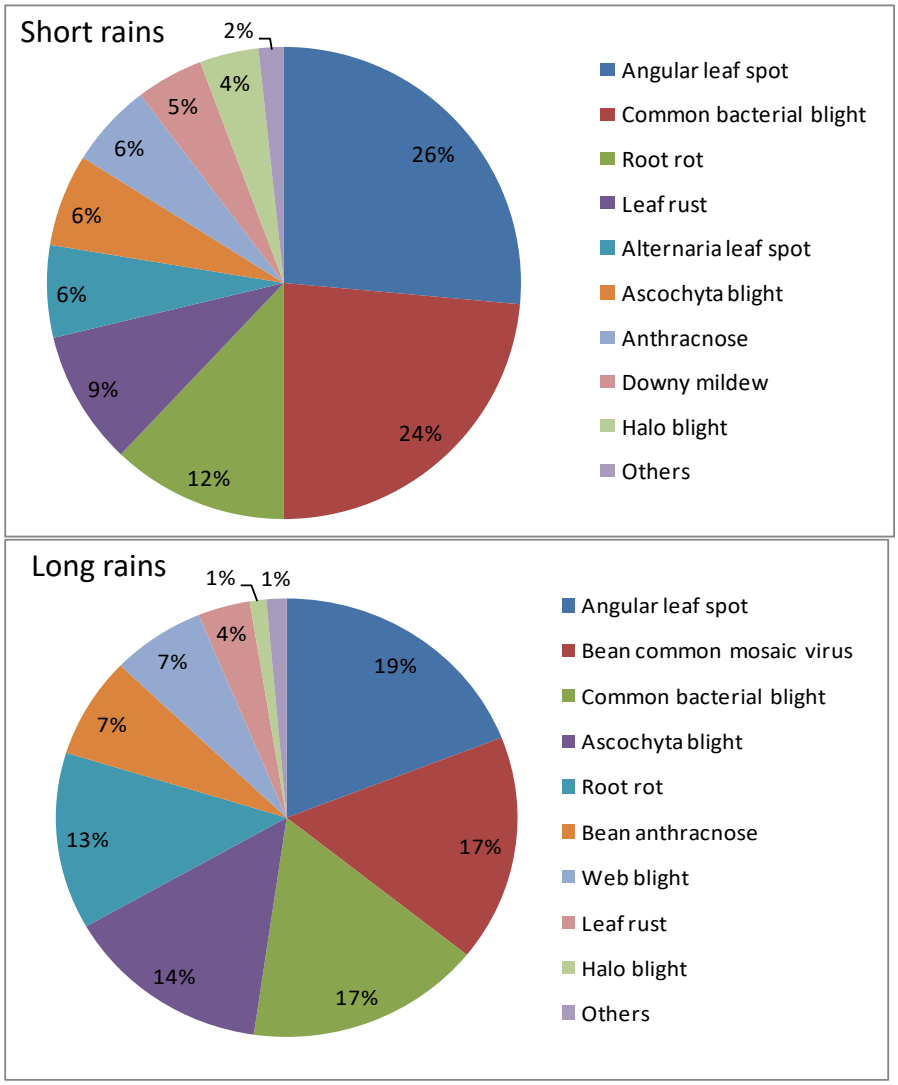

Figure 1. Frequency (%) of diseases affecting common bean during short rains 2012 and long rains 2013

There was variation in disease indices of the three major diseases of common bean farms. In some regions, there were higher disease indices - mostly for common bacterial blight and root rots - in farms where farmers were participating in legume up-scaling projects than in non-participating farms.

Table 1. Total disease indices (%) for the diseases affecting common bean in different regions and agro ecological zones in western Kenya

AEZ	Region	CBB	ALS	Root rot	Rust	Asco	Anthra	Web	Total
LM1	Rongo	48.3	68.3	45.0	35.0	20.0	15.0	3.3	33.6
	Butula	70.0	90.0	38.3	11.7	0.0	0.0	5.0	30.7
LM2	Rangwe	78.3	55.0	66.7	20.0	40.0	15.0	0.0	39.3
	Busia	55.0	90.0	41.7	26.7	0.0	0.0	0.0	30.5
LM3	Siaya	83.3	63.3	76.7	8.3	1.7	3.3	0.0	33.8
LM4	Bondo	86.7	26.7	58.3	11.7	1.7	1.7	0.0	26.7
UM1	Sabatia	70.0	90.0	53.3	20.0	10.0	6.7	1.7	36.0
	Nandi south	80.0	70.0	63.3	13.3	3.3	3.3	0.0	33.3
LH1	Nandi south	51.7	41.7	23.3	40.0	48.3	11.7	8.3	32.1
Mean		69.3	66.1	51.9	20.7	13.9	6.3	2.0	

Mean index of all the diseases; Disease index (0 - 6) is a total of distribution (0 - 2), incidence (0 - 1) and severity (0 - 3) per disease; AEZ – agro-ecological zone; LM1 – lower midland zone 1; LM2 – lower midland zone 2; LM3 – lower midland zone 3; LM4 – lower midland zone 4; UM1 – upper midland zone 1; LH1 – lower highland zone 1; CBB – common bacterial blight; ALS – angular leaf spot; Asco – Ascochyta leaf spot; Anthra – anthracnose; Web – web blight; Rust -Leaf rust

Discussion

There was high prevalence of fungal and bacterial diseases of common bean in all the regions covered in the study in western Kenya. This might have been due to favourable weather conditions and sub-optimal production practices (Hirano *et al.,* 1995). Most foliar disease pathogens cause considerable damage when weather conditions are favorable. Disease incidence, distribution and severity differed among agro-ecological zones most likely due to differences in weather conditions (Jaetzol*d et al.,* 2006;). Environmental factors such as elevation, humidity and precipitation affect the occurrence of pests and diseases (Fininsa and Tefera, 2006).

Foliar diseases affect crop productivity and yields (Muthomi *et al.,* 2007) leading to declining agricultural productivity, poor rural livelihood and poverty (Giller *et al.,* 2011). Common bacterial blight was the most prevalent bacterial disease in all the regions. This concurs with the findings by Saettler (1989), who concluded that common bacterial blight was the most important foliar diseases in East Africa especially in hot and humid areas. Root rots, on the other hand, were the most common fungal disease. The high prevalence of root rot diseases could be due to over cultivation without period breaks between cropping seasons or a lack of crop rotation, to break the pathogen cycle, all attributed to small land sizes. This result in decreased soil fertility and pathogen inoculum build up and consequently increased disease occurrence (Gichangi *et al.,* 2012). Common bacterial blight and root rots can cause yield losses of up to 40% and 70%, respectively (Nzungize *et al.,* 2012). Farmers also rely heavily on own saved seed from previous seasons for planting. Research conducted by Gichangi *et al.* (2012) indicated that, most small scale farmers in Kenya planted uncertified seeds saved from previous harvest, borrowed from the neighbours or

purchased from the local markets. Such seed is often infected and its use allows the pathogen to constantly thrive in the seeds and soil.

Conclusion

There was a high prevalence of fungal and bacterial diseases of common bean in western Kenya. This could be due to favorable weather conditions and poor agronomic practices used by the farmers which results in huge yield losses. Farmer training programmes on good agronomic practices should be encouraged and further research is recommended to come up with common bean varieties specific to agro-ecological zones.

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