Original Research Article

Survey of Cultural Practices and Assessment of Some Foliar Fungi Diseases of Common Beans (*Phaseolus vulgaris* L.) 1n The Western Highlands of Cameroon

ABSTRACT

Aims: To assess the different cultural activities that influence the spread of fungal diseases on common bean and record the prevalence, severity and incidence of the disease in some localities of the Western Highlands of Cameroon.

Study design: Structured questionnaire, Field survey, Laboratory identification of fungal diseases.

Place and Duration of Study: Some subdivisions of the Western Highlands of Cameroon and Departments of Crop Protection University of Dschang and Catholic University of Cameroon Bamenda from May 2016 –December 2017.

Methodology: Field inspection formats were developed in the form of structured questionnaire and interview guide to record data related to farmer's agronomic practices. A total of two hundred and eighty farmers and other stakeholders were interviewed on various aspects of agronomic practices. The survey of foliar fungal diseases was done in 2017 second cropping season (August to December) following the main roads and accessible routes in each surveyed area. Stops were made randomly every 1-2km intervals depending on the proximity of farm field to one another. Three sampling sites per farm were assessed for disease prevalence**,** incidence and severity using the CIAT evaluation scale of 1-9. Leaf samples were culture in PDA.

Results: Majority of farmers practiced shifting cultivation and mixed cropping. The organic fertilizer poultry manure is widely used closely followed by pig, cow and goat dung. As regards mineral fertilizers, 59.7% of farmers indicated the application of different inorganic fertilizers on their farms. The results indicated that the highest observed diseases in the various localities were angular leaf spot, rust, anthracnose, white mould, leaf yellowing, floury leaf spot and Ascochyta leaf spot in that descending order in terms of prevalence, incidence and severity.

Conclusion: From the assessment, angular leaf spot is a serious threat to common bean production in these localities. Its spread and that of the other fungal diseases is greatly influenced by the various cultural practices. Proper agronomic practices and information on disease monitoring are key to the improvement of bean cultivation.

Keywords: Cultural practices, ALS, common bean, disease, incidence, severity.

1. INTRODUCTION

Common bean (*Phaseolus vulgaris* L.) is the world's most important food legume for direct human consumption. Average per capita consumption of common bean in the main bean production areas is higher in Africa, estimated at 31.4kg/year [1]. High in nutrients and commercial potential, common bean holds great promise for fighting hunger, increasing income and improving soil fertility in Sub Saharan Africa. The crop occupies more than 3.5 million hectares in sub-Saharan, accounting for about 25% of the global production but production is concentrated in the densely populated areas of East Africa, the lakes region and the highlands of southern Africa (http://webapp.ciat.cgiar.org/ciatinfocus). In Africa, common bean is a popular crop among small-scale farmers, given its short growth cycle (about 70 days which permits production when rainfall is erratic). Common bean is often grown by women farmers mainly for subsistence and markets [2]. It is often grown as cash crop by small scale farmers and used as a major food legume in many parts of the country where it is consumed in different types of traditional dishes. The common bean (*Phaseolus vulgaris* L.) is a major grain legume consumed worldwide for its edible seeds and pods [3, 4]. In Cameroon, common beans is mainly cultivated and marketed in the Western Highlands of Cameroon [5, 6]. This region contributes more than 90% of the national bean production [7]. It is grown for its high nutritional value and potential as a source of income for the small holder farmer. This makes haricot beans an ideal crop for simultaneously achieving three developmental goals: reducing poverty, hunger and improving human health [8]. Just like in other parts of Africa, small scale farmers usually intercrop beans with other crops like maize, cassava cocoyam, plantain [9].

In the Western highlands of Cameroon, various cultural practices are carried out in the cultivation of common bean. Some of these practices include season of planting, type of cropping system (sole or intercropping) time of planting (sowing date), type of variety being cultivated and type of farm input being used. In terms of planting season common bean is normally grown twice a year by majority of farmers. The first production is during the rainy season (March to June) and second is during the dry season (August to December). Majority of farmers in this region usually intercrop beans with other crops especially cereals like maize. According to Siri et al. [6], many farmers mentioned that intercropping is preferred for two main reasons: minimize cost of production and security against crop failure as a result of pests and diseases or bad weather. As in other bean growing regions of Africa, the majority of farmers get their seeds mainly from informal channels which include farm saved seeds, seed exchanges among farmers and/or local grain/seed market. A distinct purpose of common bean production (whether for grain or seed) by smallholder farmers is virtually lacking and products from preceding one or two seasons are usually used as planting material for succeeding seasons regardless of the cropping system used to produce them [10].

Soil infertility, periodic water stress (drought), insect pests and diseases are considered the principal agronomic constraints of the crops [11, 12, 13]. Diseases may cause 80-100% yield loss while pest damage, especially during the early seedling stage and pod formation, also causes severe yield losses. Anthracnose, rust, and angular leaf spot are widely distributed, while rhizoctonia web blight and ascochyta blight can be locally intense in warm-moist and cool-moist environments, respectively. In the past few decades, root rots have emerged as a greater problem [14], especially those caused by *Pythium spp.* and *Fusarium spp*. Pests and diseases of the common bean may be controlled by a number of control measures which include the adoption of appropriate cultural practices, judicious use of fungicides and use of resistant varieties [15]. The objectives of this study were to evaluate some cultural practices that influence the spread of some foliar fungal diseases on common bean and the assessment of their prevalence, incidence and severity in some localities of western highlands.

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2. MATERIAL AND METHODS

2.1 Survey of cultural practices

Survey of various cultural practices that influence cultivation of common bean was conducted in some divisions in the North West and West regions of Cameroon. In the North West, the following divisions were taken into consideration: Boyo, Bui, Mezam and Donga-Mantung. In the West Region the survey was conducted in Bamboutos, Menoua and Noun (Figure 1). The surveyed localities were purposively selected to represent the major bean growing areas of these regions. Sites and farmer's selection were carried out through discussions with sub divisional agricultural officers and through observation of secondary data. Discussions with stakeholders were carried out with the objective of extracting information regarding constraints on crop production. The constraints include the prevalence, incidence and severity of important bean diseases and their distribution, damage caused to the crops, and their methods of prevention and control. Field inspection formats were developed in the form of structured questionnaire and interview guide to record data related to farmer's agronomic practices. The researcher used a self-designed questionnaire for data collection which comprised both closed-ended and open-ended questions. The following agronomic practices were taken into consideration in the questionnaire: method of cultivation, planting, husbandry or management, pest and disease management, harvesting, preservation and storage, and production and marketing**.** A total of two hundred and eighty (280) farmers/stakeholders were interviewed and some of their fields were observed to investigate their current cultural practices in the selected divisions.

2.2 Survey sites and assessment of diseases

An observation method survey to determine the prevalence and incidence of some major foliar fungal diseases affecting common bean was conducted in some localities in the North West and West Regions of Cameroon. In the North West Region, the assessment was conducted in the following Sub Divisions: Belo, Njinikom of Boyo division, Jakiri and Kumbo of Bui Division, Bali and Bamenda II in Mezam Division. The following Sub Divisions/localities were considered in the West: Bababjou and Mbouda in the Bambotous; Dschang in the Menoua Division (Figure 2).

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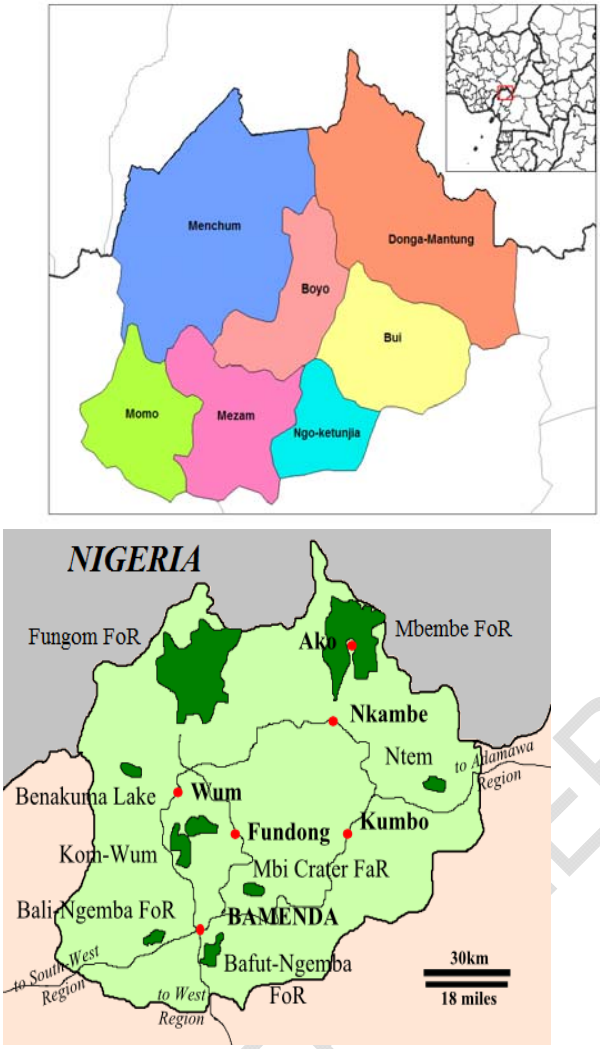

Figure 1: Maps of Northwest Region showing the different divisions/subdivisions surveyed

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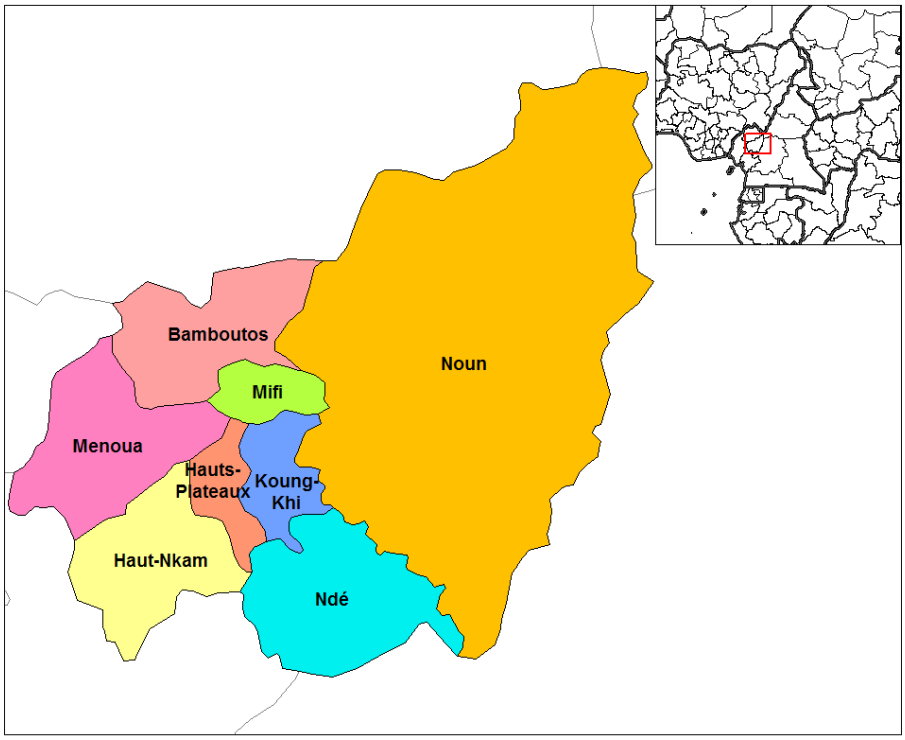

Figure 2: Maps of West region showing the different divisions surveyed

The Sub-divisions were selected based on the intensity of bean production, spatial and ecological location. The survey was conducted in the 2016 short cropping season (from late September to early December). This was the period when the crops were in R_4 – R_8 stages (flowering to late-pod filling). A combination of both purposive and simple random sampling methods was used to select the bean fields and sampling sites [16]. The survey trips were made following the main roads and accessible routes in each survey locality [17]. Stops were made randomly at every 1-2km intervals depending on the proximity of farm field to one another. One hundred farmers' fields were visited in the two regions. Three sampling sites which were 10m apart [18], were randomly selected per farm and bean plants were assessed for disease prevalence, incidence and severity. Stops or samples were made in each common bean field by moving in 'W' fashion of the fields [17].

At each site, 100 plants were assessed for various foliar fungal diseases resulting in a total of 300 plants examined per field. The prevalence of the disease was computed by using the number of fields affected by a particular disease divided by the total number fields assessed per Sub-division and expressed as percentage [19, 17]. The assessment of each disease was based on the disease incidence, which is the number of diseased plants compared to the total number of assessed plants and expressed as a percentage [17]. Ten infected bean plants were randomly selected in each site for estimating disease severity. In other words, severity was estimated as percent leaf area diseased per plant for ten plants per site. Thus averagely three samples per field were used. Assessment of the severity was based on the respective scales for each of the identified disease. The 1-9 scale of CIAT was taken as standard to score different foliar diseases [1]. In this scale, diseased bean variety having scores of 1-3 show resistant, 4-6 being intermediate (tolerant) and 7-9 being susceptible for that particular disease. Thus, the scale helps to categorize bean germplasm. The numbers 1,3,5,7,9 are used to score the severity of major diseases [15].The severity of the disease

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was examined visually on the trifoliolate leaf and recorded as the percentage leaf area affected. Scoring for each disease was done on three trifoliate leaves selected at the bottom, middle and top of each plant [20]. The mean disease score for the plants per field assessed was then calculated. Disease ratings were based on the extent of number of leaf lesions and area of leaf damaged by the pathogen involved. Severity diseases percentage scale is advantageous as it provides upper and lower limits of the scale; the scale can be divided and subdivided [21]. Initial identification of the various foliar fungal diseases observed was made based on symptoms as described in the *Compendium of Bean Diseases* [22].

2.3 Isolation and Identification of various foliar fungi

Common bean leaves showing typical disease symptoms, collected from susceptible plants during survey were used for isolation of pathogen organisms. Representative samples of all diseased leaves of plants (two leaves) showing symptoms of suspected foliar disease, from the different surveyed localities were collected, placed between two clean papers, labeled and taken to the laboratory of the Catholic University of Cameroon (CATUC) Bamenda in order to confirm field identifications through microscopic observation. Specimens of diseased leaves were cut with the help of a sterile micro scissors into small pieces about 2 cm long comprising of a part of diseased lesion and a portion of healthy tissue. The bits were placed in specimens of diseased leaves were cut with the help of a sterile micro scissors into small pieces about 1 cm long comprising of a part of diseased lesion and a portion of healthy tissue. The bits were surface sterilized for five (5) minutes in 10% sodium hypochlorite solution and followed by 2-3 rinses with sterilized distilled water. The sterilized pieces were placed on 2.5% Potato Dextrose Agar (PDA) media amended with 10 mg l^{-1} rifampicin and 200 mg l^{-1} of ampicillin. The plates were kept at room temperature in the laboratory for 5 to 7 days. Fungal growths on each plate were sub-cultured to a new plate and the plates were kept in an incubator at 27–29 ◦C. The growth of fungi was observed daily for their typical morphological features such as shape, size, septation and colour of mycelium, synnemata and conidia were studied under laboratory conditions. These were then compared with standard descriptions given by Schwartz *et al*., [22] for identification of the pathogens**.** Later pure cultures of the isolated fungi were identified morphologically using a compound microscope and observed at magnification of 10 x and 40 x. Data was analyzed using descriptive statistics in Microsoft excel 2010.

3. RESULTS

3.1. Survey of Cultural Practices

The frequency distribution of the farming method, planting, and crop management practiced by farmers in some localities in the North West and West regions is shown in Figure 3a and b. According to the respondents 46.8% of farmers cultivate their farms in both rainy and dry seasons. This is closely followed by those who do a lot of cultivation in the first or long rainy season (36.4%). In terms of farming system, many farmers carry out crop rotation (41.4%), followed by those that practice fallowing (27.5%), while the least value was obtained from those who practice all the various forms and others (0.7%). With respect to cropping system, majority of farmers carry out mixed cropping (88.2%), while 11.8% practice monocropping.

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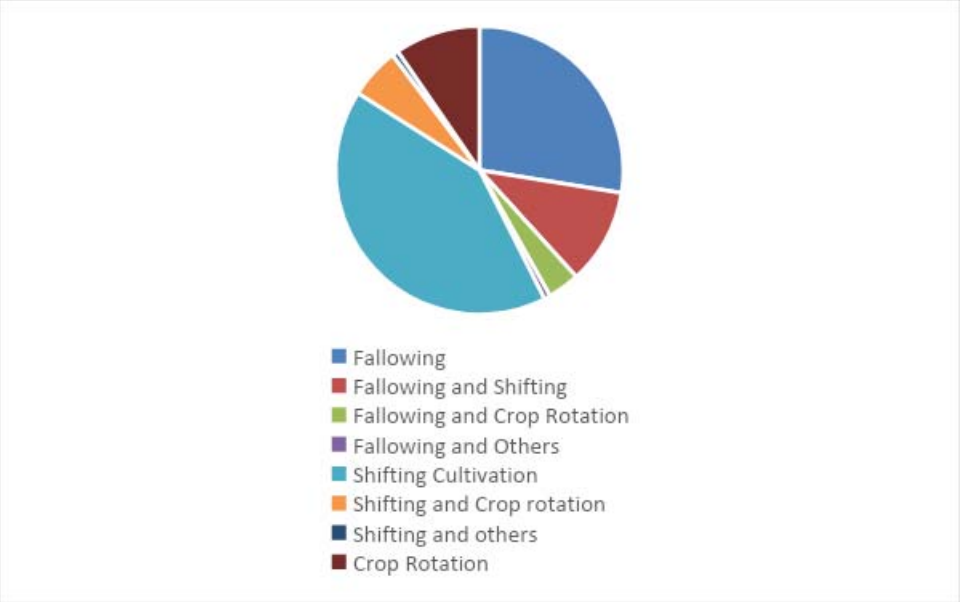

Fig.3a. Different farming methods in the two regions

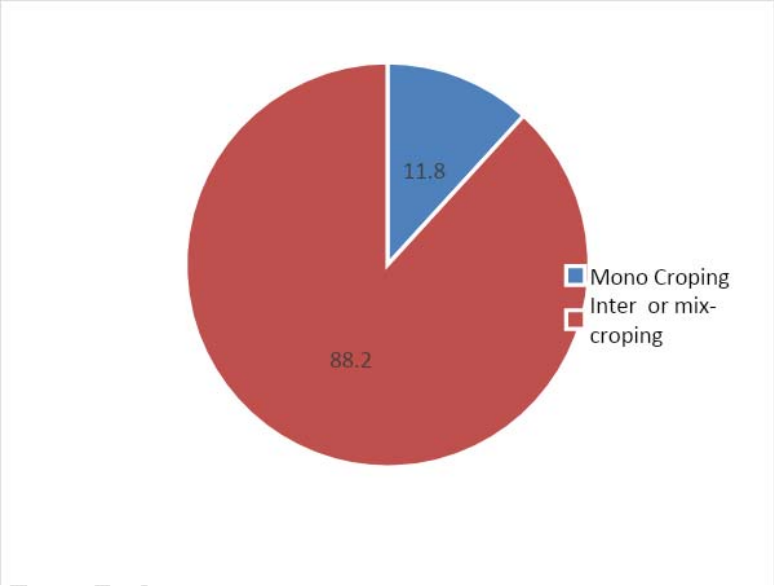

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Fig. 3b. The main cropping systems practiced in the two regions

In terms of variety of beans being cultivated, many farmers prefer planting dwarf/semi-climbing varieties (35.0%). This was closely followed by the black climbing type (19.6%) (Figure 4).

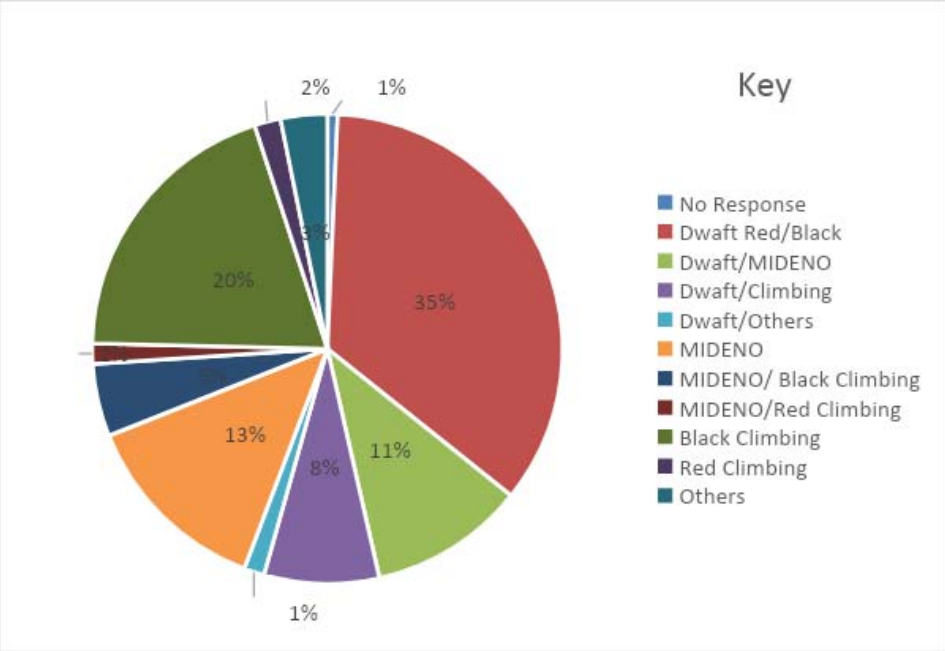

Fig. 4. The different varieties of common bean being cultivated in the two regions

Their preference for these varieties is the fact that they produce well (46.4%) and equally taste well (15.0%) and less laborious compared to the staking types (1.4%) (Figure 5).

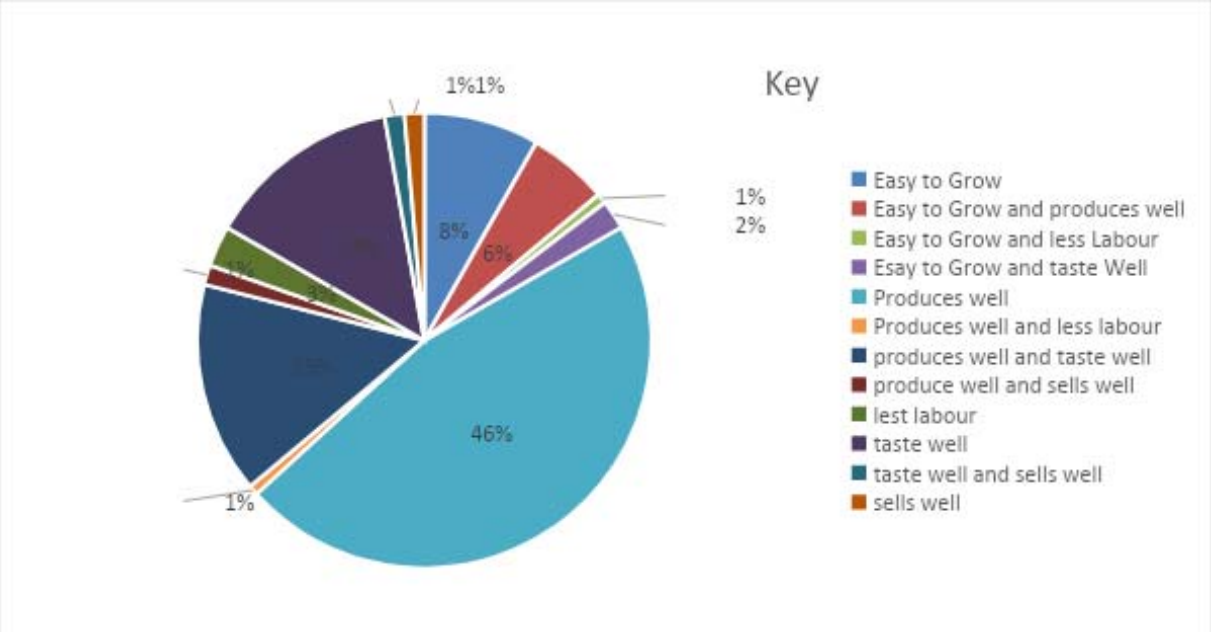

Fig. 5. Preference for different varieties of common bean

As regards the source of seeds for planting, many respondents (44.6%) indicated that they purchase the seeds from various markets and research centers. This was closely followed by those who always use previously harvested seeds (35.4%). The use of organic manure of

different types is a common practice carried out by a good number of farmers in both regions (62.8%). Only 34.7% indicated the non-use of manure. Poultry manure was the most commonly used organic manure (38.2%), followed by those who frequently use pig/cow/goat dung (11.2%) with the least obtained from those who apply kitchen wastes on their farms (0.7%) (Figure 6).

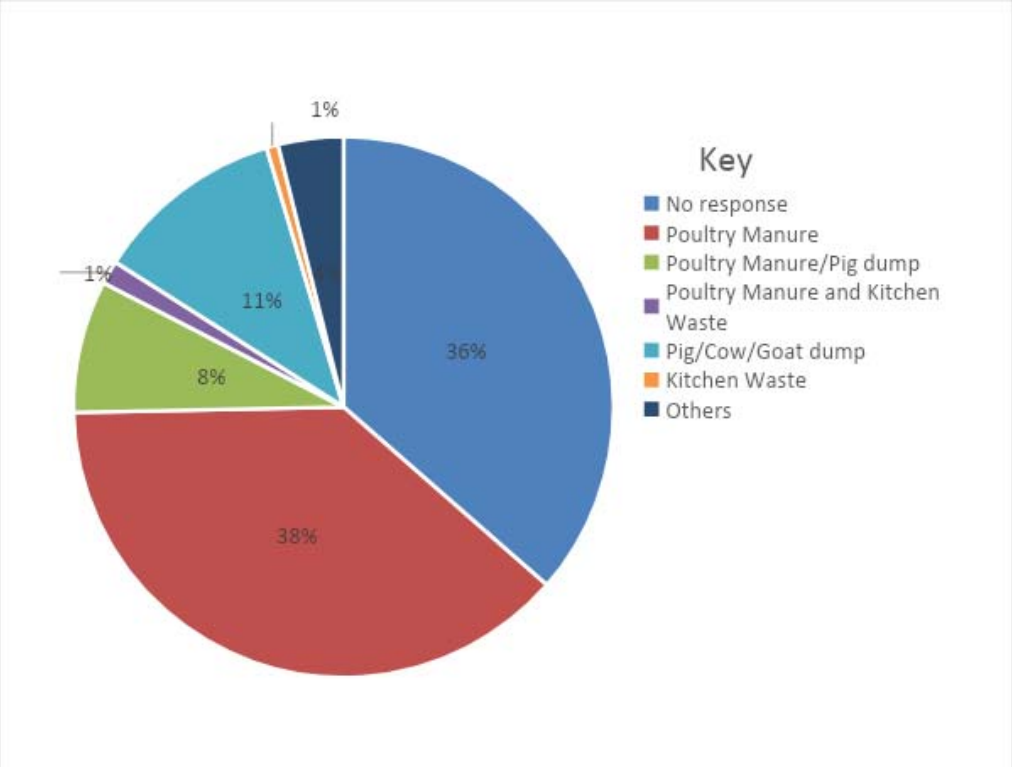

Fig. 6. Application of different types of organic manure by farmers

With respect to quantity of manure being used 25.7% apply averagely a kilogramme/litre in form of manure per ridge or stand, while the least (3.6%) was from those who use a cup. As regards mineral fertilizers 59.7% of farmers indicated the application of different inorganic fertilizers on their farms. The most commonly used type being 20.10.10 (53.9%), while the least was obtained from those who use 14.24.14 fertilizer (1.1%) (Figure 7).

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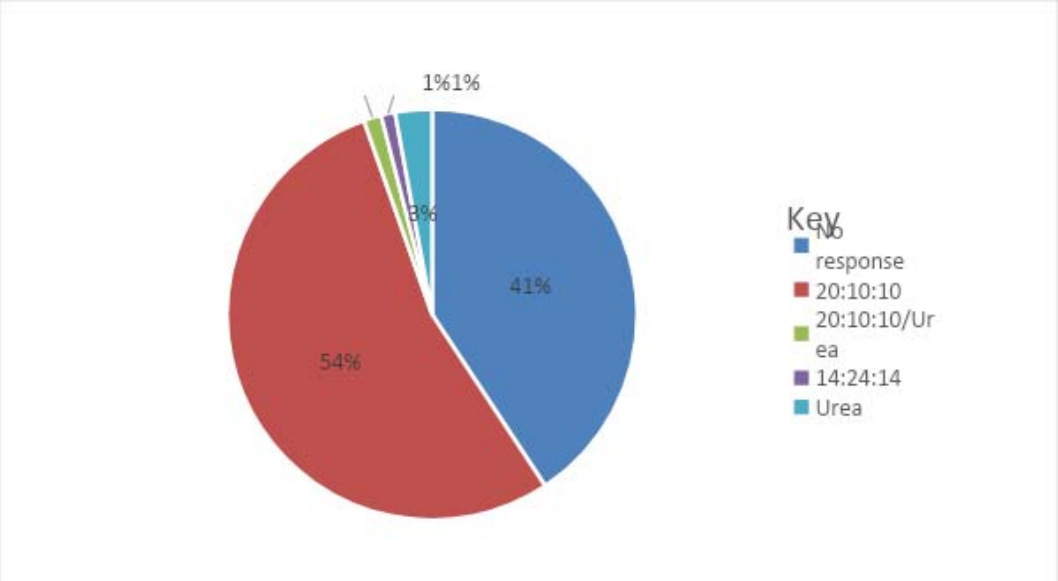

Fig. 7. Application of different types of inorganic fertilizers by farmers

However, many of them applied this farm input more to other crops like maize (52.3%) than to the beans. A few do apply for both beans and other crops (2.9%). Only a small percentage indicated the use of mineral fertilizer on bean crops (1.1%). Many of the farmers (67.9%**)** usually noticed one form of damage on their bean crops at the different stages of growth, especially the vegetative stage (68.2%). 36.8% of damage is thought to be caused by insects, while 18.2% is caused by diseases. The leaves are the most affected parts (46.1%), followed by the stem (3.9%). With respect to nature of damage, 29.7% of the respondents indicated that damage on the leaves is in the form of holes, while 12.2% usually noticed weak leaves and stem. A good number indicated that they sometimes spray the crops with chemicals (27.2%) while others use other measures (18.8%) to prevent/control insect bites/diseases. Many respondents did indicate that the remains (wastes) are usually either piled up to decay in the farm and later used as manure or are burnt (50.4%) after harvesting the crop (Figure 8a, b and c).

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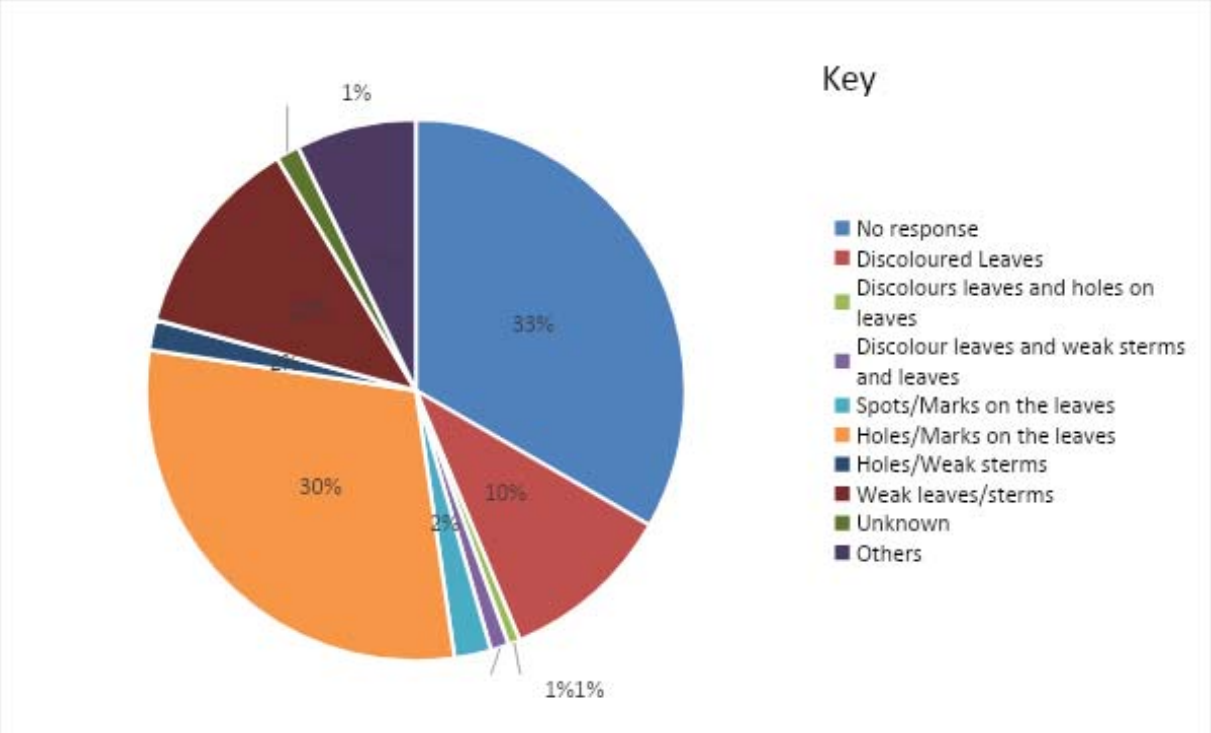

Fig. 8a. Different damages on the crop at different stages of growth

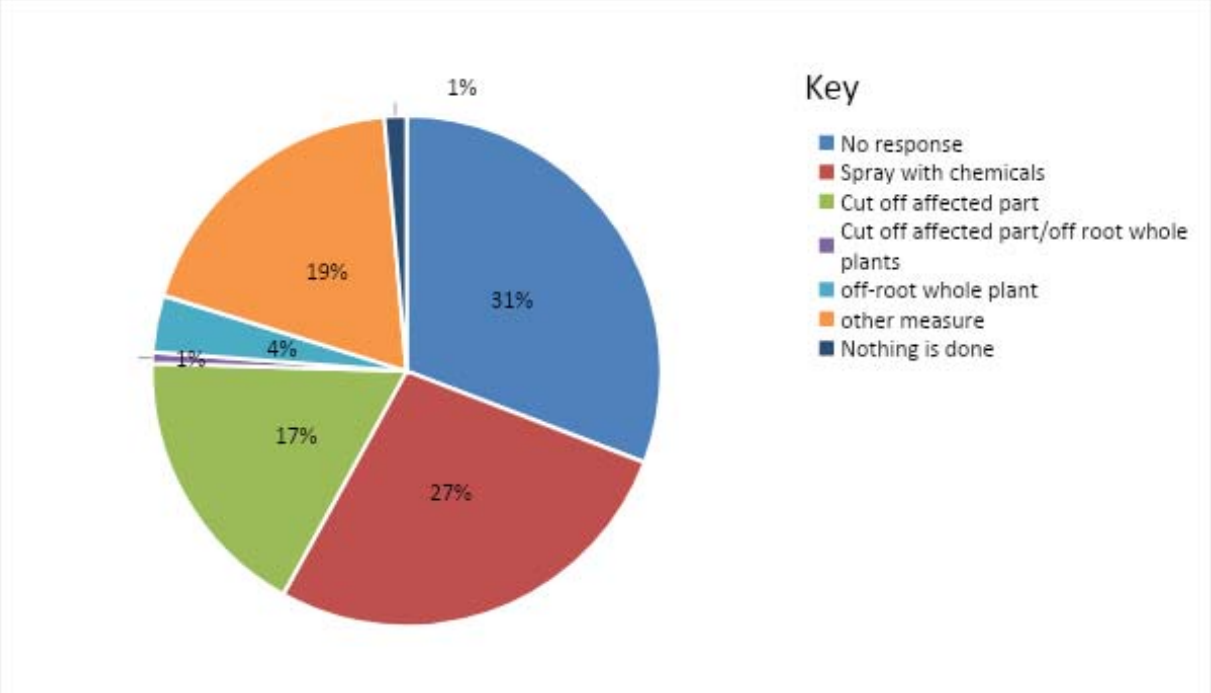

Fig. 8b. Some methods used by farmers to prevent and control various diseases and pests attack on the crop

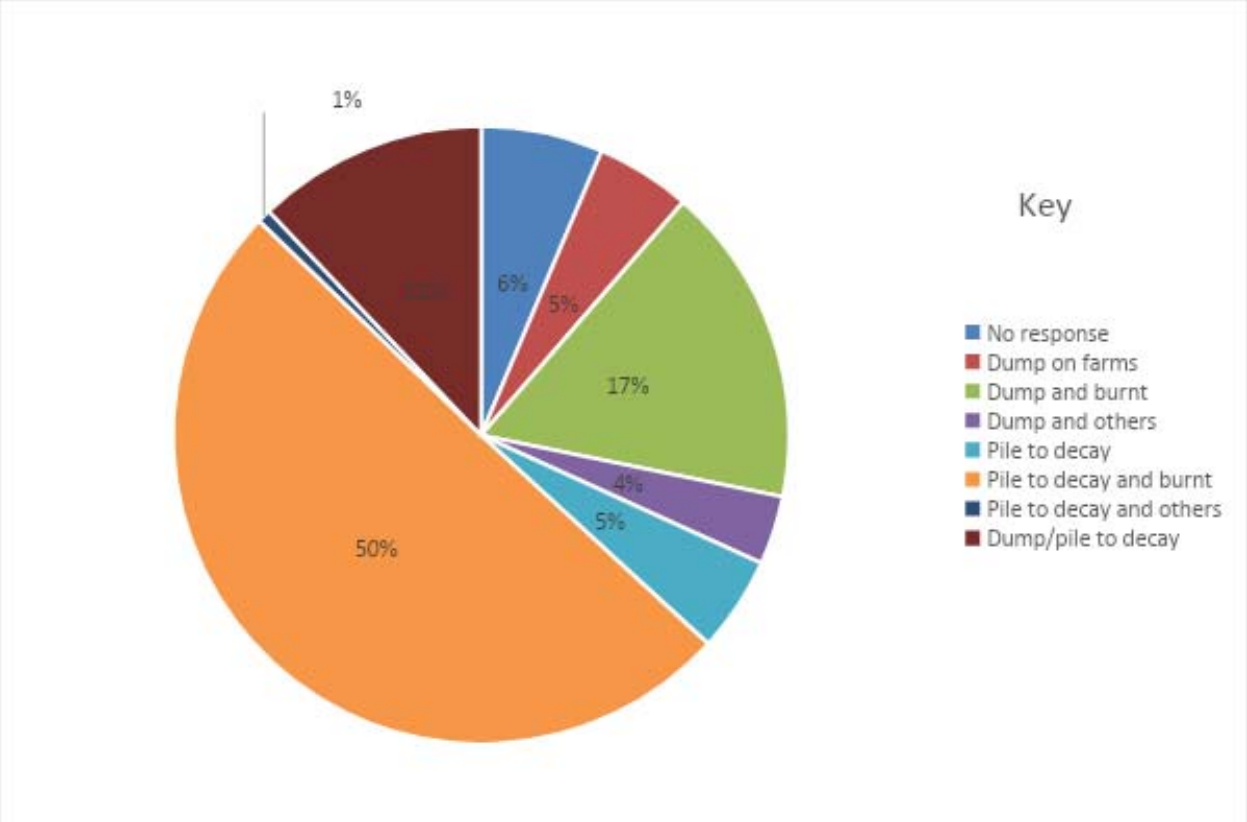

Fig. 8c. Different ways of disposal of plant remains after harvesting of pods

In terms of production, many farmers usually produce between 50-75 kg/ha of beans (43.9%) in the rainy season and 50-100kg/ha in the dry seasons (15%). The least percentage (3.6%) in the rainy season was from those who could not quantify the amount they usually produce. In the dry season, 11.4% indicated that they only produce averagely150kg/ha per harvest. In terms of preservation, 21.4% opined that they sun-dry pods thresh and store dry seeds in bags. Also a reasonable number indicated that after sun-drying and shelling the pods, they usually treat seeds with chemicals or local herbs before storing (15.7%).The least respondents was from those who tie harvested beans in bunches and store in ware houses or barns (0.7%).

3.2 Assessment or survey of foliar fungal diseases of common bean

Disease prevalence: Seven foliar diseases were identified in the different subdivisions (localities). These were Angular leaf spot (ALS), rust, Anthracnose white mould, leaf yellowing, Ascochyta leaf spot and floury spot in that descending order of prevalence. Angular leaf spot occurred in all the localities and was recorded in 95% of the farms visited. The prevalence ranged from 75% in Menoua to 100% in Boyo division. The highest mean disease prevalence according to locality was ALS (0.61%) at Belo. This was closely followed by Njinikom. There was no significance difference (P≤ 0.05) in the prevalence of ALS in the different subdivisions. Rust was the second most prevalent disease. It was equally found in all the divisions (subdivisions). The highest prevalence was witnessed in the Boyo and

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Mezam division (65%) and the least in Bui and Menoua divisions (45%). The highest mean prevalence of rust according to localities (subdivisions) was recorded at Mbouda (0.45%) and the least found in Kumbo (0.25%). The least prevalent disease was Ascochyta leaf spot which occurred only in two localities Bamenda (0.05%) and Jakiri (0.046%) (Figure 9).

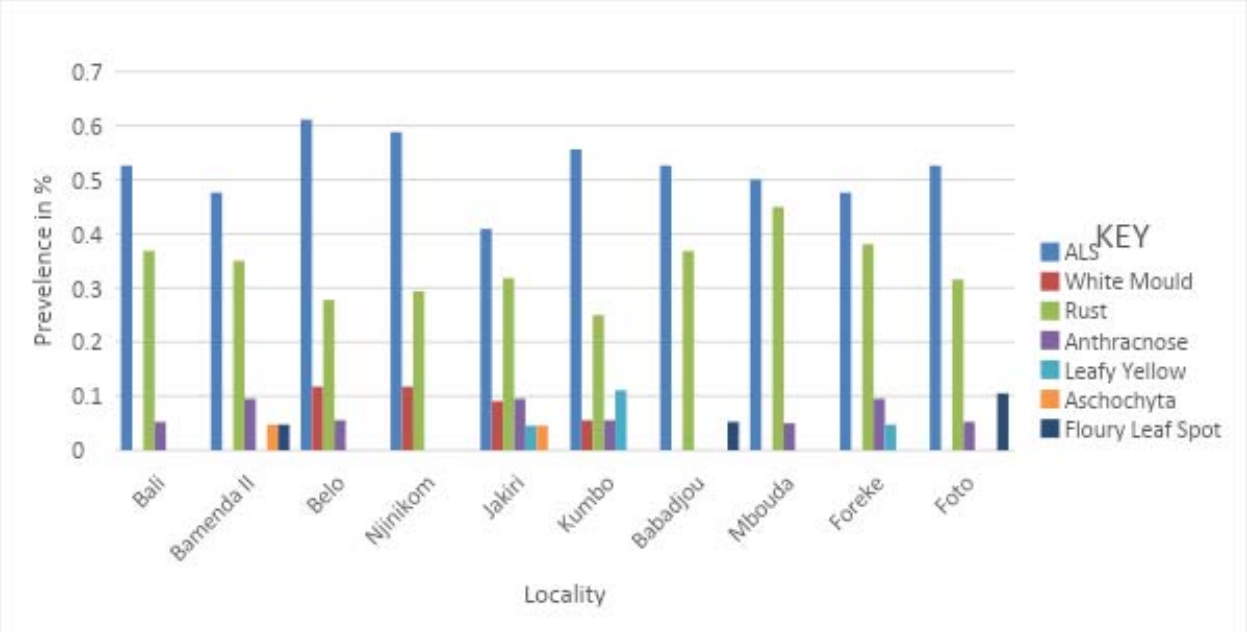

Fig. 9. Prevalence of different foliar diseases in the various localities

Disease incidence: Just like prevalence, ALS had the highest incidence in all the localities. The highest mean incidence was recorded in farms in Babadjou (41.1%) closely followed by Njinikom (40.0%). ALS incidence was least at Bamenda II (21.3%). Rust was the next disease, with the highest incidence (12.579%) recorded at Babadjou and the least at Belo (11.9%). Ascochyta in Bamenda II had the least incidence (0.2%). There was a significance difference at P≤ 0.05 with regards to incidence in the different divisions (Figure 10).

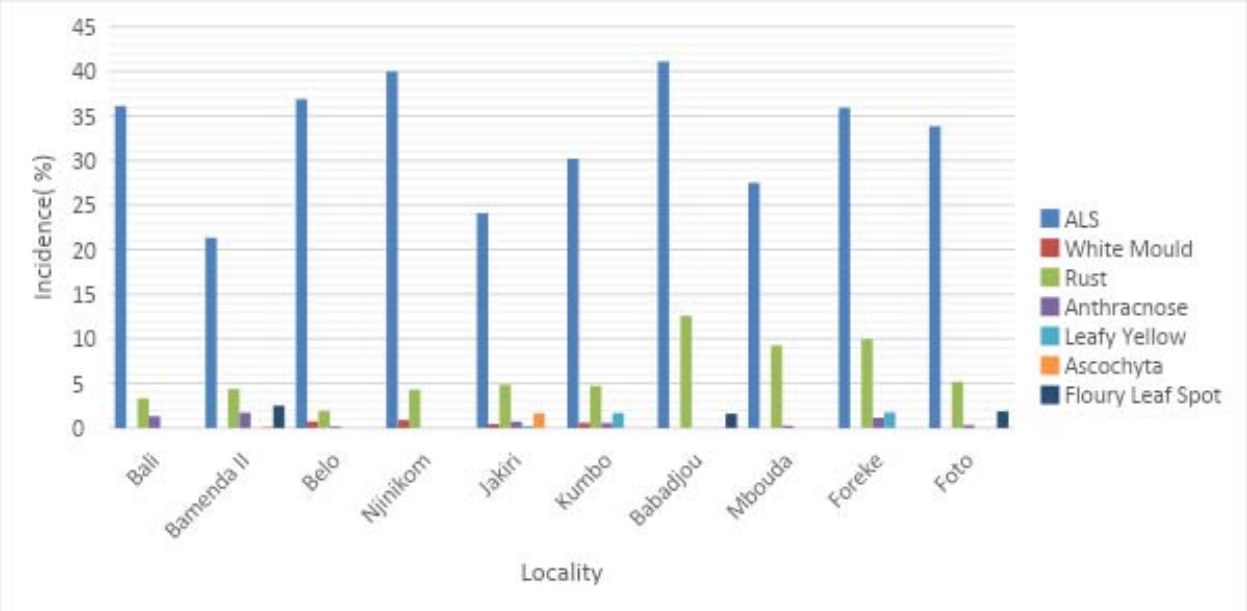

Fig. 10. Incidence of different diseases in the various localities

Disease severity: The highest disease severity was witnessed in crops infected by ALS. This was closely followed by rust. ALS had the highest severity at Njinikom (42.9%) and the least at Bali (3.2%). The least severed disease was Ascochyta leaf spot at Bamenda II (0.2%). Disease severity was significantly different (P≤0.05) in the various divisions, with the mean severity in Mezam and Menoua significantly different from Bamboutos. There was a significant difference (P≤0.05) between Bamenda and Mbouda subdivisions (Figure 11).

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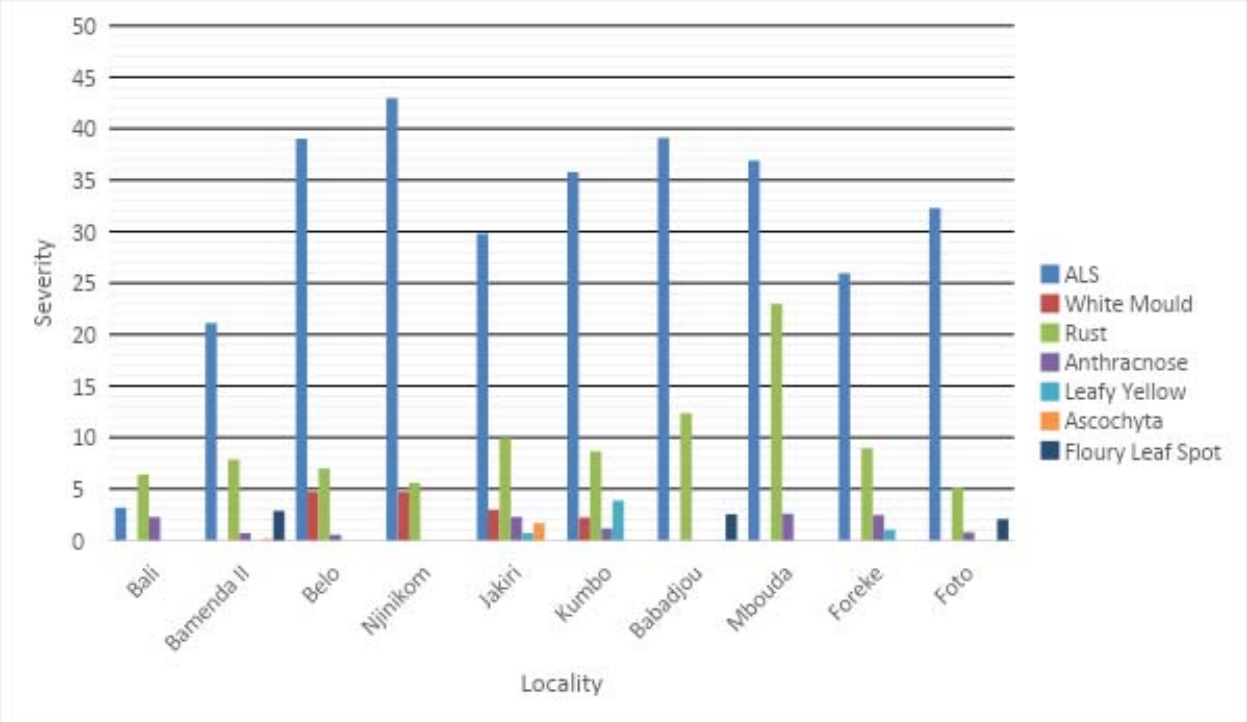

Fig. 11. Severity of different foliar diseases in the various localities

In the Western highlands, the highest prevalence, incidence and severity of foliar fungal diseases was recorded with Angular leaf spot (ALS) while the least prevalence, incidence and severity was recorded with Aschochyta leaf spot (ASL) Table 1.

Table 1. Prevalence, incidence and severity of foliar diseases of common bean in the Western highlands of Cameroon

Disease	Causative organism	Prevalence %	Incidence %	Severity %
Angular leaf spot (ALS)	*Phaeoisariopsis griseola*	95	75.1	75.4
Rust	*Uromyces appendiculatus*	54.17	28.95	28.28
Anthracnose (ANTH)	*Collectotrichum lindemuthianum*	5.00	9.02	12.73
White mould (WM)	*Sclerotinia sclerotiorum*	2.5	1.31	3.77
Leaf yellowing (LY)	*Fusarium oxysporium*	4.17	6.78	8.69
Aschochyta leaf spot (ASL)	*Phoma exigua*	0.84	0.98	2.5
Floury mould (FM)	*Mycovellosiella phaseoli*	4.59	14.45	9.99

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4. DISCUSSION

4.1 Cultural practices

Common bean is an important component of several cropping system on a global scale. In Cameroon, beans are produced either as monocultures or more often as a component of intercropping systems. From the present study, it was revealed that majority of farmers in the Western Highlands practice intercropping (mixed cropping) especially in the first season (rainy season). Farmers in the NWR intercropped haricot beans with various crops like maize, potatoes, huckleberry, groundnut and cocoyam in order to diversify production per unit area of land especially during the first season [6]. It was observed on farmers' fields that haricot beans are commonly intercropped with maize due to their strong agronomic compatibility. According to Siri *et al*, [6], farmers mentioned that intercropping is preferred for two main reasons: minimize cost of production and security against crop failure as a result of pests and diseases or bad weather. Furthermore, it was revealed that intercropping was also meant to satisfy the family taste for varieties of crops. Intercropping is therefore an important aspect of livelihood diversification with the potential of diversifying the food basket of small-scale agricultural producers. Intercropping is first regarded as insurance against severe environmental stresses or high incidence of diseases, diversifying the farmer's production basis and decreasing production risks [4]. Fernandez-Aparicio et al. [23] were of the view that intercropping is advantageous for soil conservation, weed control; lodging resistance, improves yield and legume root parasite infection control. Jenkins [24] reveals that monocropping of red haricot beans is more profitable for the households compared to planting it in association with other crops. This affirms the findings of this study, where farmers in the West Region produced and marketed larger quantities of beans as a result of monocropping practiced during the second season that runs from August to December. Farmers in this region reported that with increasing pressures on agricultural land resulting from population growth, they had to explore new ways to intensify production per unit area of land.

From the findings, it was revealed that majority of farmers did not use mineral fertilizer. Moreover, when mineral fertilizers are used, they are rather applied to crops other than common bean. In the present studies it was revealed that 52.3% apply mineral fertilizer to the benefit of crops like maize. [25, 26] reported that in Malawi and Zimbabwe, when mineral fertilizers are used, they tend to be applied to maize or other high-value cash crops such as banana, but not to beans. Many of the farmers complained of high fertilizer cost and other farm inputs. According to Saginga et al. [27] fertilizers would increase production, however, unaffordable prices and low quality of mineral fertilizers, together with the lack of local infrastructure, markets, institutional and political will limit large scale applications of mineral fertilizers. High levels of N and P fertilizers would indeed be necessary to overcome the low fertility of many African agricultural soils [28]. On the other hand, majority of farmers in this region frequently use different types of organic manure (fertilizers) though to a varying quantities and at different stages of crop growth and development. Organic manure like poultry manure are easily available, affordable and less costly, compared to mineral fertilizers. [29, 30] concluded that application of plant residues (like *Tithonia, Serna hirsute* at rates of $4tha^{-1}$) are as effective as application of inorganic NPK fertilizers containing some amounts of N as the organic materials for increasing maize and bean yields. Many respondents (50.4%) indicated that the plant debris are either piled in the furrow to decay or are burnt. This practice has been known to promote the spread of various field diseases, since most of the crop debris serve as inoculum build up for re-infestation of future crops. According to [31], infected seeds, plant debris, volunteer plants and off season crops have been identified as important sources of *Phaeoisariopsis griseola* inoculum.

Due to the presence of numerous diseases and vectors that invariably lead to yield losses in beans and other crops, many farmers are involved in the cultivation of different varieties of beans and other crops. The use of diversity of traditional crop varieties continues to be part

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of disease management strategy in genetically diverse systems for such farmers [32]. Loss of local crops, which reduces the varietal choice also reduces the farmers' capacity to cope with changes in pest and disease infestations, and leads to yield instability. Mulumba et al. [33] have shown that increased diversity of crop varieties in the case of beans and banana (*Musa spp*), as measured by number of varieties (richness) and their evenness of distribution, corresponds to a decrease in the average damage levels and reduces variance of disease damage. Farmers plant many bean cultivars on the same farm to fulfill various needs and ensure yield stability [34, 35]. The selection of cultivars to be grown depends on yielding ability, market value, and suitability for inter-cropping, taste and cooking properties and availability of seeds and resistance to diseases and pests. Some cultivars are preferred for home consumption while others fetch better prices in the market. Cultivation of bean varieties on the same farm, even though not necessarily as mixtures, may have the effect of lowering disease spread among crops [16]. [36] demonstrated that using bean mixtures significantly lowers angular leaf spot severity because the cultivars may contain varying levels of resistance to different races.

4.2 Prevalence and severity of foliar fungal diseases

Of all biotic constraints that curtail crop productivity, diseases are the most devastating agents from an economic standpoint and the most difficult to protection efforts [17]. In the survey angular leaf spot was consistently found to be the major disease in the different localities in the two regions. In all fields inspected ALS and rust were predominantly found. These diseases have been widely reported in the highlands of Cameroon [15]. ALS incited by *P. griseola*, has been reported to course more than 80% yield loss in bean fields found in this region [37]. [38] reported that common beans are widely susceptible to diseases such as Bean Common Mosaic Virus (BCMV), Angular leaf spot (ALS), Common Bacterial Blight (CBB), Anthracnose and Halo blight. Both ALS and rust are known to strive well under different environmental conditions such as variation in humidity (rainfall) and temperature. Too much rain has been reported to cause pods to get rot and it was impossible to get any healthy mature pods. Through farmer's visits and interviews, we learned that they don't plan ta lot of (dry) beans during the first cropping season (March) because of too much rain and inability for beans to dry during this period. Similar bean crop losses due to heavy rains followed by a drought spell have been reported by other researchers elsewhere [39]. High humidity and rainfall tend to increase the dispersal of spores of most disease causing organisms and therefore leading to increase in severity. In Cameroon, [15] concluded that extreme wetness of 2009 cropping season may have favoured the spread of the fungi on infected plants. This led to increased severity of ALS disease in that year. A general agreement exists among authors that adequate moisture (95-100% relative humidity) and favourable temperatures (20-25^{0}C) are critical requirements for the successful infection of the host and sporulation of the pathogen [40]. More to that infested soil debris may have contributed to further spread the diseases. Rust was found affecting dry beans in almost al the localities. The disease has the potential of causing 100% crop damage. Rust is generally considered as one of the top five diseases that is of greater concern to bean growers [41, 42, 43]. Another contributing factor for the high incidence and severity of ALS and rust and to a lesser extent anthracnose is the various cultural practices observed on the fields. Most of the fields visited carry out intercropping of bean with other crops like maize, cocoyam, and cassava was a common feature. This tends to promote disease spread. Anthracnose, rust and angular leaf spot are widely distributed while rhizoctonia, web blight and aschochyta blight can be locally intense in warm- moist and cool-moist environments respectively [3].

Disease incidence and severity were generally high and varied significantly among the divisions and subdivisions and also from one farm to another even in the same location. This may be attributed to factors such as amount of inoculum present in each farm, level of field sanitation and type of cropping system. Infected seeds, plant debris and volunteer plants are

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some of the important sources of *P. griseola* inoculum that influence development of ALS in the field [31]. The high prevalence, incidence and severity of angular leaf spot and rust occurring in the Western Highlands may, to a certain extent, be attributed to the farming practices adopted by smallholder farmers who are the main producers of different varieties of common bean in these regions. Due to an increase in pressure on land, consequent to an ever- increasing human population, farmers till their land throughout the year without any fallow or crop rotation. In addition, farmers use their seeds from the previous season or supplement their seed requirements with purchases from informal markets [44, 34, 35].This results in inoculum build-up, which contributes significantly to the development of disease epidemics. Barro et al.[45] reported that ALS increased dramatically in Columbia when four bean crops were planted per year in Cauca valley. Continuous cropping with little or no farm inputs like fertilizers or manure also results in a poorly established crop that is more prone to extensive disease damage. Similarly, as farmers try to maximize on their small pieces of land, there is close-cropping which leads to increased disease severity as a result of prolonged humidity retention [45]. According to Wortmann et al. [13], intense cultivation under increasing population pressure results in declining soil fertility or soil compactions or both, and inbuilt up of pathogen inoculums in the soil. A similar scenario is observed in these two regions especially in the semi urban and urban areas where there is continuous use of the same pieces of land year in and out due to population pressure and urbanization activities.

5. CONCLUSION

From the assessment, angular leaf spot is a serious threat to common bean production in these localities .Its spread and that of the other fungal diseases is greatly influenced by the various cultural practices. Considering that most bean production takes place in an intercrop system with maize and other crops, understanding quality of seed produced and different cultural practices (seed quality, seed source, type and quantity of farm inputs used, farm hygiene etc.) are primordial in producing and distributing high quality acceptable seeds free of pathogens to farmers, under different cropping system would be a sound strategy for the improvement of common bean production in this region in particular and Cameroon as a whole.

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