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Sweetpotato Diseases Research in Ethiopia

Shiferaw Mekonen, Fikre Handoro, Fekadu Gurmu*, Elias Urage
Hawassa Agricultural Research Center
*Email: fekadugurmu@yahoo.com, Tel. +251 911743625,
Fax: +251 462200084, P.O.Box, 06, Hawassa, Ethiopia

***Abstract* – Sweetpotato [*Ipomoa batatas* (L) Lam] is among important crops in Ethiopia. It is annually produced on 53,000 hectares of land with total production around 4,240 tons and average productivity of 8 t ha-1. The productivity of the crop is extremely low as compared to the average world yield of 14.9 t ha-1 and potential yield of 45 t ha-1. One of the factors is the existence of sweetpotato diseases in the country. Hence, this paper reviews the types of diseases in Ethiopia, their status, prevalence, incidence and managements. Currently, virus is the major economically important disease in Ethiopia. Especially, since late 2004 to 2011 four types of viruses namely, Sweetpotato feathery mottle virus (SPFMV), Sweetpotato chlorotic stunt virus (SPCSV), Sweetpotato virus (SPVG) and Sweetpotato virus 2 (SPV2) were identified and recorded viral diseases in the country. Six viruses, namely, C-6 virus, Sweetpotato caulimo-like virus (SPCaLV), Sweetpotato chlorotic flecks virus (SPCFV, Sweetpotato latent virus (SPLV), Sweetpotato mild speckling virus (SPMSV), and Cucumber Mosaic Virus (CMV) were identified in 2012. In addition, sweetpotato stem blight caused by Alternaria spp., is also considered as intermediate and sometimes threatening sweetpotato production and productivity in the country. In order to manage these threatening diseases, it is recommended to strengthen local quarantine system, training of farmers, experts and multipliers. Moreover, it is also important to clean and distribute virus free planting materials to reduce the present status of the disease and its effect on the resource poor farmers and multipliers.**

***Keywords* – Disease Management, *Ipomoa Batatas*, Sweetpotato Diseases, Sweetpotato Virus.**

I. INTRODUCTION

Sweetpotato [*Ipomea batatas* (L) Lam.] is a crop that is tolerant to a wide range of edaphic and climatic conditions. It is also more tolerant to cold than other tropical root and tuber crops and therefore it can be grown at altitudes as high as 2500 masl (Luisa and Robert, 2000). It is one of the most important subsistence crops in many parts of Africa as well as worldwide. In addition, it is a good source of income for small scale farmers in Africa with production estimated at 7.5 metric tones, which is about 6% of the world production (FAO, 1988).

In Ethiopia, sweetpotato is grown around a densely populated area in the South, Southwestern and Eastern parts of the country and is one of the most important crops for at least 20 million of Ethiopians (Tofu *et al.,* 2007). Over 95% of the production is obtained from the South, South western and South eastern parts of the country (Belehu, 1987). About 53,435 ha of land are annually covered by sweetpotato in the main rainy season (CACC, 2010). In terms of area coverage and production, it ranks the third among root and tuber crop next to enset (*Enseteventricosum*) and potato (Million, 2002; CSA, 2011; 2012). In the country, Oromia and Southen National Nationality People Regional State (SNNPRS) are the major producers, which contributes 52.15% and 47.15% annual sweetpotato production, respectively (CACC, 2010). In SNNPRS sweetpotato grows as subsistence crop by small-scale resource poor farmers, mainly in Wolayta, Gamo Gofa, Dawro, Kembata and Tambaro and Hadiya zones. Currently its production is being increased since it is being introduced and cultivated in different regions of the country, namely, Gambella, Benshangul-Gumuz, Harari, Dire-Dawa and Somale.

Although the crop is increasingly introduced in different regions of Ethiopia and also the country has a very suitable climatic and edaphic factor for production of sweetpotato, the national average yield is only about 8-10 t ha^{-1}. This is quite low as compared to the average world yield of 14.9 t ha^{-1} (FAO, 2001) and its potential yield of 45 t ha^{-1} (PRAPACE, 2003). This low productivity of the crop is associated with many factors. Among various factors, insect pests and diseases are the major once that are known to cause a yield reduction as high as 98% (Kapinga*et al.,* 2007). Of the plant pathogens; viruses, fungi and bacteria are responsible for increasing economic losses of sweetpotato worldwide. Among the pests, viruses are the second most significant constraint followed by the sweetpotato weevil (Qaim, 1999). Since the crop is sensitive to viral disease infection, its quality as well as the quantity of yield and yield components is highly affected by virus. (Tewodros et *al*, 2011) .

Sweetpotato virus disease (SPVD) is the most important disease of sweetpotato in Africa (Geddes, 1990; Lenné, 1991) and perhaps worldwide (Carey *et al*., 1999). Greater than 20 viruses are known to infect cultivated sweetpotato worldwide (Fuglie, 2007). In African countries such as Nigeria and Uganda, sweetpotato virus accounts for about 50% yield loss. In East Africa, over 90% yield reductions have been associated with viruses (Gibson *et al*., 1998). Similarly, it is reported to cause yield reduction of 56 - 98% (Mukasa*et al.*, 2003; Ndungur*uet al*., 2007).(SPVD) has been reported East Africa countries such as Uganda since 1944 and later in Kenya, Tanzania, Rwanda, Burundi, and Malawi. Even though, sweetpotato virus is a devastating disease worldwide, in Ethiopia, it was not considered as a limiting factor until 2004 (Abraham, 2010). However, since late 2004, it has been recognized as an important disease that greatly reduces yield of sweetpotato (Geleta, 2009).

In order to manage the threatening viral diseases of the crop, so far many efforts have been made in different countries. Karyeija*et al*. (2000) reported that the use of more resistant landraces for planting has reduced SPVD

incidence in the field to some extent and resulted in improved yields. Also many efforts have been made to produce virus-free plants materials through shoot-tip culture and its effective method (Nagata, 1984). However, it is costly as well as the initiall virus-free sweet potato often becomes infected .in the field.

In SNNPRS, widespread of viral infection and severity on sweetpotato was observed from 2006- 2009 in both research and farmers' fields, which also resulted in the reduced production and productivity of the crop. Consequently, many efforts have been made to identify sweetpotato diseases and to develop control measures in the country (Abrham, 2010; Tewdros, *et a*l 2011). However, there were no much consolidated and detailed literature reviews made on the past research findings of sweetpotato diseases in the country. Therefore, the objective of this paper is to review sweetpotato diseases research findings available in Ethiopia, So as to device effective management options to control the diseases.

II. Research Findings

2.1. Sweet potato diseases recorded in Ethiopia

Different types of viral, fungal and bacterial diseases have been recorded in Ethiopia (Table 1). The first virus disease (*SPFMV)* has been reported in Ethiopia by Scientific Phytopathological Laboratory in 1986 (SPL, 1986). Of all diseases, viral diseases are considered as major constraint for production and productivity of the crop in the country. On the other hand, most of the fungal and bacterial diseases recorded in the country are considered as minor disease except sweetpotato stem blight caused by *Alternaria*spp (Tesfaye, 2013).

Table 1: Sweetpotato diseases recorded so far in Ethiopia

Disease	Scientific name	Reference
SPFMV	Poty virus	SPL (1986) and Tamru (2004)
SPVG	Poty virus	Tamru (2004)
SPCSV	Crinivirus	Abreham (2010)
SPV2	Poty virus	Abreham (2010)
SPVD (SPCSV+SPFMV)	Crinivirus+Poty virus	Abrham (2010) and Tamru (2006)
C-6 virus		Anonymous (2012)
SPCaLV		Anonymous (2012)
SPCFV	Carlavirus	Anonymous (2012)
SPLV	Potyvirus	Anonymous (2012)
SPMSV	Potyvirus	Anonymous (2012)
CMV	Cucumovirus	Anonymous (2012)
Leaf blight	AscohytaHortorum	PPSE (2009)
	Alternaria sp.	PPSE (2009)
Stem blight	Colitotricumspp,GlomerellaSingulata)	PPSE (2009)
	Alternaria sp.	PPSE (2009)
Leaf rust	Pucccinicaholosericiea	PPSE (2009)
Leaf rust	Pucccinicaholosericiea	PPSE (2009)
Leaf spot	Xanthomonasvesicatoria	PPSE (2009)

2.2. Diseases identification and prevalence

The first report of virus on sweetpotato in the country was made before two decades by electro-microscopy and the virus was tentatively identified as *Sweetpotato Feathery Motile Virus (SPFMV*) [Scientific Phytopathological Laboratory (SPL), 1986)]. *SPFMV* is the most common virus infecting sweetpotato in Africa (Karyeija*et al*., 1998). Alemu (2004) conducted a survey and confirmed the presence of *SPFMV* and another virus, namely, *Sweetpotato virus G (SPVG)*, mainly from Wolayita and Sidama zones of the country through serological test using antiserum in DAS-ELISA. Of 318 sweetpotato samples of different varieties that were collected and tested for virus, 62.8% revealed *SPFMV* infection, which also commonly found in all locations. The highest (86%) and lowest (32%) virus incidences were found in samples collected from Humbo and SodoZuriadistincts of Wolaita zone, respectively. There was also varietal difference observed in sensitivity to *SPFMV*. For instance, samples taken from the cultivar 'Gadissa' had a higher percentage of *SPFMV* infections than that of 'Ogansegen'. At the same time, it has been proved that samples taken from farmers' cutting materials maintenance field revealed a higher percentage of *SPFMV* infections than sample taken from production fields.

Abraham (2010) also conducted a survey and collected samples from AARC and Wondo Genet sweetpotato germplasms maintenance field to determine level of virus contamination in Ethiopia. This author reported the occurrence of *Sweetpotato chlorotic stunt virus* (*SPCSV)* and *Sweetpotato virus 2 (SPV2* viruses for the first time in Ethiopia from samples collected from germplasm resources and sweetpotato accessions from Hawassa and Wondo Genet research stations usingNitrocelullose

Membrane ELISA (NCM-ELISA). Out of 57 accessions serologically tested from Hawassa, 22 and 21 accessions were found to be infected by *SPFMV* and *SPCSV*, respectively. Similarly, serological analysis of 122 accessions from Wondogenet revealed that SPFMV was the most frequent (62%) followed by *SPCSV (*10%) and *SPV2* (1.6%) (Table 2). The presence of SPVD or mixed infection was also confirmed. This result indicates the presence of high level of virus contamination of germplasm resources in Ethiopia. Abrham (2010) recommended the need for developing urgent measures to stop further spread of the virus across the production systems in the country along improved materials. This is very important particularly in southern Ethiopia where sweetpotato plays a significant role as a food security crop.

A survey has been made in 2007/ 2008 cropping season by Awassa Agricultural Research Center (AARC) to know the prevalence, incidence and distribution of sweetpotato virus and to understand the influence of SPVD on yield of sweetpotato in southern region of Ethiopia especially Sidama, Gedeo, Amaro, Wolaita, Gamogofa and Kembata zone (Table 3). The samples were collected from both on-farm and research station. The results indicate that the highest SPVD incidence was observed in Hawass Agricultural Research Center followed by kembata and wolaita zones on-farm trial (100%, 75%, 66.7%) respectively. Whereas at Wolaita and Sidama zones sub research centers a virus incidence of about 37.30% and 40%, respectively were recorded (Tesfaye, *et al*., 2013). Of all surveyed area, samples collected from Amaro farmers' field were free of SPVD incidence (Table 4).

Table 2: Proportion of sweetpotato accessions on which virus-like symptoms and/or individual viruses were detected

Symptoms of virus	Location		Total
	Hawassa (%)	Wondogenet (%)	
Symptomatic	68.4	93.4	86.5
SPFMV	38.6	62.2	56.5
SPCSV	36.6	10.2	18.5
SPFMV+SPCSV	12.3	3.9	6.5
SPV2	1.8	1.6	0.6

Table 3: Sample size and location assessed for diseases (virus) and associated insect pests in SNNPRS of Ethiopia in 2007/2008 cropping season.

Location/Zones	Sample size	Altitude range	No. of sweetpotato examined	
			On farm	On station
Sidama	31	1700-1920	2	16 (Hawssa)
Gedeo	14	1560-1745	2	-(no testing site)
Amaro	11	1420-1610	1	9 (Kelle)
Wolaita	45	1540-2140	2	- (Kokate) harvested
G/Gofa	30	1200-1580	2	15 (Sawlla and Chano mille)
KembataTambaro	35	1550-1900	2	- (No testing site)

Table 4: Sweetpotato virus disease incidence and distribution in major sweetpotato growing areas of SNNPRS of Ethiopia

Location/Zones	Sweet potao virus disease incidence			Remark
	On-farm (%)	On-station (%)	Laboratory test	
Sidama	37.3	100	+	
Gedeo	25.0	-	+	
Amaro	0.0	62.5	+	
Wolaita	66.7	-	+	No crop at the time
Gamogofa	40.0	46.7	+	
KembataTambaro	75.0	-	+	No testing site

Table 5. The status of diseases and insect pests recorded on sweetpotato.

Disease	Species (SPPs)	Status	*Remark*
Stem and leaf blight	Aletrnaria spp.	Intermediate	
Virus	SPVD	major	
Leaf spot	Phomopsis	minor	
Cercospora leaf spot	Cercospora	minor	

Tesfaye*et al* (2013) also confirmed the status of sweetpotato diseases in Southern Ethiopia. SPVD and sweetpotato stem blight caused by *Alternaria* spp., which are found in all surveyed areas of SNNPRS, considered as major and intermediate disease of sweetpotato diseases respectively (Table 5). These diseases are threatening sweetpotato production and productivity in the county.

To determine the effect of *SPVD* influence on yield, 10 plants root weight and number were taken from each location. The result indicated that the disease has reduced the number and weight of roots per plant (44.7) and (32.4) percent per plant, respectively (Table 6).

Tewodros*et al.,* (2011) conducted a survey and made serological detection on sweetpotato virus with aim to assess the magnitude of virus diseases attacking sweetpotato in the main production areas of the country (Oromia and SNNPRS) regions. Ninety seven sweetpotato fields were visited in eastern and southern Ethiopia in 2009 and a total of 235 symptomatic and 735 asymptomatic vine cuttings were collected (Table 7) and tested for ten type of virus (*Sweetpotato chlorotic stunt virus(SPCSV)*, *Sweetpotato feathery mottle virus* (*SPFMV*), *Sweetpotato mild mottle virus* (*SPMMV*), *Sweetpotato chlorotic fleck virus* (*SPCFV)*, *Sweetpotato caulimo-like virus* (*SPCaLV), Sweetpotato mild speckling virus* (*SPMSV*), C-6(flexious rod virus), *Sweetpotato latent virus* (*SwPLV),Sweetpotato virus* G (*SPVG*) and *Cucumber mosaic virus* (*CMV*)) using NCM ElISA kit. Average prevalence of virus and virus-like symptom were 15.6% in Wolayita, 12.5% at Awassa Agricultural Research Center (HARC), 10% in Hadiya, 6.3% in Gamo Gofa , 0.15% in Kembata-Tembaro, 0.1% in Sidama and 0.03% in East Hararge. The most prevalent virus was *SPFMV* (15.1%) followed by *SPCSV* (12.9 %) and *SPVG* (4.5%). Mixed infection of *SPFMV + SPCSV* was the most common co-infection observed (9.3%) followed by *SPVG+SPCSV* (3%) of the total samples. No viruses found in any of the samples obtained from Eastern and Western Hararge zones (Table 7).

Table 6: Effect of Sweetpotato Virus Disease (SPVD) on number of roots and weight per plant

Location/ Zone	Healthy		Diseased		Reduction (%)	
	Average no of roots per plant	Average weight of roots per plant (kg)	Average no of roots per plant	Average weight of roots per plant(kg)	Root	Weight
Sidama	4.6	0.45	2.24	0.13	48.5	28.9
Gedeo	5.1	0.36	1.85	0.17	36.3	47.2
Amaro	4.5	0.52	2.83	0.31	63.6	59.6
Wolaita	5.2	0.51	2.11	0.05	40.9	9.8
Gamogofa	4.8	0.55	2.62	0.27	54.6	49.1
Kembata	4.8	0.41	1.17	0.04	24.6	9.8
Mean	4.8	0.46	2.13	0.16	44.7	32.4

Table 7: Proportion of symptomatic and asymptomatic sweetpotato samples, detected serologically with NCM-ELISA kit in eight zones in Ethiopia in 20009.

Locations/Zones	Asymptomatic		Symptomatic	
	Sample Assayed	Percentage	Sample Assayed	Percentage
HARC	10	30	10	90
Sidama	5	0	5	20
Hadya	5	0	5	100
Wolaita	206	9.2	134	83.6
Gamogofa	96	8.3	34	67.6
KembataTambaro	9	0	11	100
E.Hararge	36	314	0	0
Western Hararge	90	0	0	0
Total	**735**	**4.1**	**235**	**68.5**

Source: (Tewedros et al., 2011)

It has been reported an average of 20.7% of samples tested positive for at least one virus. Of the symptomatic samples, 68.5% of the samples reacted positive with antisera of one or more viruses with the frequency of detection being highest in samples from Hadiya and Kebata-Tembaro followed by Awassa, Wolayita and Gamo Gofa (Table 7). From asymptomatic sweetpotato samples only 4.1% reacted positive with antisera of at least one virus. Virus diseases were distributed in most of the zones with frequencies of detection ranging from 20-100 % and 8.3-30 % in the symptomatic and asymptomatic samples, respectively (Table 7 and 8).

Three sweetpotato infecting viruses namely, SPFMV, SPCSV and SPVG were detected by NCM-ELISA in both symptomatic and asymptomatic sweetpotato. The frequency of detection was higher in symptomatic than asymptomatic plant samples. From the symptomatic samples, 133 (56.6%) and asymptomatic 13 (1.8%)

reacted positive for *SPFMV*, indicating that *SPFMV* was the most prevalent virus. *SPCSV* was the second most frequent virus detected in 112 (48.9%) of the symptomatic and 10 (1.4%) asymptomatic samples SPVG was the third but occurred in low frequency being detected in 28 (11.9%) of the symptomatic and 16 (2.1%) of the asymptomatic plant samples (Table 8).

In 2012 cropping season, a survey was made by AARC and Ambo Plant Protection Center (APPRC) to determine the status of virus disease on sweetpotato multiplication fields. Accordingly, 45, 68 and 45 symptomatic samples were collected from Wondo Genet, Leku privet multiplier field and Southern Agricultural Institute (SARI), respectively and brought to APPRC laboratory for serological test.Each sample was tested against antibodies of 10 viruses, namely SPFMV, SPVG, SPCSV, *C-6,* SPCaLV,SPCFV, SPLV,and Sweetpotato Mild Mottle Virus (SPMMV),SPMSV andCMV. Viruses which were reported previously as economically important on sweetpotato, *SPCSV, SPFMV, SPVG* and*SPCSV+ SPFMV* were distinguished and they were commonly encountered as well (Anonymous, 2012). Out of 158 samples tested, these viruses were detected in 77 (52.02%),33 (22.29%) and 25 (16.89%), of samples collected from Leku, Wondo Genet and SARI, respectively (Table 9).

Table 8: Proportion of symptomatic and asymptomatic sweetpotato plant samples tested positive for at least one virus when assayed serologically by NCM-ELISA from eight zones in Ethiopia 2009.

Location/ Zone	Plant Assayed		SPFMV (%)		SPCSV (%)		SPVG (%)	
	S	A	S (%)	A (%)	S (%)	A (%)	S (%)	A (%)
Hawassa	10	10	70	0	10	0	20	30
Sidama	5	5	20	0	0	0	0	0
Hadya	5	5	100	0	100	0	0	0
Wolaita	134	206	64.2	3.4	67.9	3.4	17.9	5.3
Kembata	34	96	67.6	6.3	23.5	3.1	5.9	2.1
Gomugofa	11	9	100	0	90.9	0	0	0
Eastern Harerge	36	314	0	0	0	0	0	0
WesternHarerge	90	0	0	0	0	0	0	0
Total	235	735	56.6	1.8	48.9	1.4	11.9	2.1

Source: Survey and serological detection of sweetpotato (Ipomoea batatas (L.) Lam.) viruses in Ethiopia (Tewedros et al., 2011).
S = Symptomatic and A = Asymptomatic

Table 9: Proportion and type of virus detected from symptomatic sweetpotato cutting samples in 2012.

Location	No. of samples	Type of virus			
		SPCSV (%)	SPFMV (%)	SPVG (%)	SPCSV+SPFMV (%)
Leku	68	44.1	10.3	14.7	7
Wondo Ggenet	45	68.9	28.9	26.7	22.22
Back up plant from SARI	45	35.6	28.9	6.7	17
Total	15 8	52.02	22.29	16.89	14.56

Source: Progress report of Awassa Agricultural Research Center 2011/ 2012

2.3. Research on management of sweetpotato diseases

2.3.1. Germplasm screening

In 2011 cropping season, 98 sweetpotato germplasm from IITA and AVRDC origins and 26 previously released and recommended varieties which obtained from Haremaye University Horticulture department were screened against virus diseases by Awassa Agricultural Research Center at hot spot areas to select disease resistance/ tolerant/ germplasm and/or varieties. Out of screened germplasms 72 and 22 varieties were well adapted and visually virus free materials were selected. The selected 94 materials (germplasm and varieties) were again planted at hot spot area of AARC and Serological test was made two times with NCM-ELISA following standard protocols described in the International Potato Centre (CIP) NCM-ELISA kit instruction manual at APPRC virology laboratory. Different viruses were detected that were not reported before (C-6, SPCalV, SPCFV, SPLV, SPMSV and CMV) in Ethiopia. SPCSV and SPFMVare the most frequently detected with 53 (55.8) and 50 (52.6%) of the samples, respectively were detected. The remaining were SPVG, 14 (14.6%), CMV 4 (4.2%), C-6, 2 (2.1%), SPMSV, 5(56%)SPCalV, 3(3.1%), SP CFV 1 (1%),and SPLV 1 (1%) (Table 10).

Mixed infection of *SPCSV* and *SPFMV* were detected in 34 (13.4%). Most of the viruses except *SPFMV, SPVG,*

and SPCSV were reported in Ethiopia for the first time. Twenty two germplasms and 3 varieties were found virus free. Those germplasm currently planted for further evaluation at Awassa Agricultural Research Center.

Table 10: Type and Percentage of virus diseases found from serologically tested germplasms and varieties in 2012 cropping season, at AARC

Genotype	Origen of Germplasm	No	Type of virus tested using NCM-Elisa Kit and % infection									
			SPCSV (%)	SPFMV %	SPMMV %	SPCFV%	SPCaLV %	C-6%	SPMSV %	SwPLV %	SPVG %	CMV %
Variety	Ethiopia	26	50	63.6	-	-	-	-	-	-	2.1	2.1
Germ plasm	AVRDC	38	63	65.8	-	10	3.1	2.1	3.1.)	10	23.6	2.1
Germ plasm	IITA	34	52.9	32.4	-	-	-	-	2.1	-	14.7	-
Total		95	55.8	52.6		10	3.1	2.1	5.26	1.0	16.0	4.2

2.3.2. Chemical screening against insect pests and diseases

Screening of chemicals against aphid and white fly was conducted in 2011 and 2012 cropping season at HARC experimental station with the objective of selecting compatible chemicals against aphid and white fly. Six treatments (five insecticides and one control) were used in the experiment. A well-known and commonly used variety, Awassa-83, was used for the expoeriment. A variety Guntutewas planted around the plot because of its susceptibility to aphids' infestation. Then, percent of aphid population was counted after spray. The result indicated that all chemical treatments significantly reduced aphid population compared to the control treatment. The highest aphid mortality percentage (83.13%) was recorded from Dimethiote treated plot, while the lowest (27.7%) was recorded from Malathion treated plot. Yield and disease incidence was not significant among chemical treated plots. However, Dimethiote and Endosulfan treatments revealed higher yield and lower disease incidence compared to other treatments. It was concluded that all insecticide treatments gave higher yield compared to the control. Therefore, Dimethoate 40% EC and Endoselfan 35% EC insecticides can be used as a component of Iintegrated Disease Management (IPM) for indirect control of virus disease.

2.3.3. Use of tissue culture materials

Virus free tissue culture materials, multiplied in foundation block of AARC and disease free planting materials were distributed to multiplier, farmers and NGOs.

2.3.4. Training

Training on agronomy, disease and pest management was given to farmers, developmental agents, private multipliers and experts of Bureauof Agriculture during distribution of disease free planting material.

III. CONCLUSION

Even though efforts were made to manage viral diseases of sweetpotato by distributing disease free planting materials in the country, the status of the disease is not reduced in farmer's fields as expected. This might be due to occurrence of diseased planting materials in most farmers' sweetpotato maintenance fields and lack of knowledge on disease management especially on symptom identification, pathtosanitary measures and quarantine issues. Generally, alternate hosts and vectors of sweetpotato viruses in Ethiopia were not well assessed and clearly known. There is also shortage of improved and disease resistant varieties and lack of virus detection chemicals for virus indexing. On the other hand internal and external quarantine system should be strengthened to certify new introduction and to reduce movement of contaminated materials locally. In addition, all released varieties which are found in the country should be cleaned from viruses by using different techniques. Breeding for virus resistance should also be put as a strategy to control the disease. Meanwhile integrated virus disease management approaches and research activities by using cultural practices, seed health and vector management should be thought of to minimize the risk of virus disease epidemic development. Developing capacity of key stake holders via training to improve sweetpotato production and management practices in the fields to discourage the occurrence of major as well as minor insects and diseases should be thought as a strategy. Testing and releasing disease and pest management technologies and demonstrating and scaling-up of already verified technologies should be done side by side by side. Finally, integrated efforts of the government, development organizations, and research and training institutes are key approaches for managing the disease and pests of sweetpotato.

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