Efficacy of Some Botanicals for the Control of Wet Rot Disease on Mechanically Injured Sweet Potato Caused by Rhizopus Stolonifer in Bauchi State

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Abstract- Laboratory experiment was conducted in the Microbiology Laboratory of School of Science and Science Technology, Abubakar Tafawa Balewa University, Bauchi, Nigeria in May, 2012 to determine the antifungal effect of different concentrations of neem and moringa seed extracts on wet rot disease of sweet potato. Moringa and neem seed extracts each with four varying concentrations (30,60,90,and 120g/L) were evaluated along with carbendazim and untreated sweet potato serving as a control constittuted the treatments. The treatment were laid out in Completely Randomized Design (CRD) with three replications. The result showed that neem seed extact was significantly ($P < 0.01$) better than th moringa seed extract in controlling the disease. Treatment of the sweet potato with varying concentrations of neem and moringa seed extracts significantly ($P < 0.01$) inhibited radial mycilial growth of R. stolonifer and also reduce the weight loss of sweet potatoes caused by R. stolonifer compared with the control, except the application of 25g/1 of moringa seed extract. Preventive method of control significantly reduce the disease than the curative method. The effectiveness of the two plants seed extracts compared favourably with carbendzim. The study revealed that there exist a potential in natural plant products for the control of crop diseases, and if fully exploited, they can replace chemical pesticide in the control of crop diseses. It is therefore recommended that farmers should used 90g/1 or120g/1 as postharvest treatment for sweet potatoes before storage as control measure for R. stolonifer.

Index Terms- Carbodenzim, moringa, sweet potato, radial growth, wet rot.

I. INTRODUCTION

Sweet potato (*Ipomoea batatas* (L) Lam) is dicotyledenous plant belonging to the farmily Convolvulaceae. The family include about 45 genera and 1000 species, with only *I. batatas* of economics importance as food. Sweet potato ranks seventh among the world's major crops with an annual production of over 100 million tones (Nwokocha, 1992).

Sweet potato is an important staple food crop, particularly in Northen Nigeria where most of it is produced. It is one of the six important root tuber crops grown in Nigeria. The other root crops are cassava, yam, Irish potato,cocoyam,and ginger. Within sub-saharah Africa, sweet potato is the third most important root tuber crop after cassava (*Manihot esculenta*) and yam (*Discorea spp*) (Ewell and Matura, 1991). Nigeria produces about 0.2% of the world sweet potato(Agbo and Ene 1994). The production of sweet potato in Nigeria can be improved by increasing crop productivity and avoiding crop failure caused by storage rot (Echerenwa and Unechuruba, 2004).

The production of sweet potato in Nigeria is constrained by several factors among which storage rot is one of the most important (Echerenwa and Unechuruba 2004). The fungi reported to be associated with rottening of sweet potato include, *Fusarium oxysporum, Ceretocysts fimbriata, Fusarim solani, Monilochaetes infuscans, Macrophomina phaseolina and Botryodiplodia theobromae* (Clark and Hoy, 1994). Onuegbu (2002) implicated *Penicillium sp*. *Cerocystis fimbriata*, *Diaporthe batatalis*, *Aspergillus flavus* and *Aspergillus niger*, as fungi responsible for decay of sweet potato tuber. Oyewale (2006) repoted fungi associated with postharvest fungal rot to include *Motierella ramanniana, Rhizopus stolonifer, Muco pusiluss, Botrytis cinerea, Erysiphe polygoni and A. flavus*. These fungi create local discoloration of the surrounding tissues of infected tubers (Snowdor, 1991), resulting in changes in appearance, deterioration of texture and possibly flavour or taste. Rot fungi causes postharvest losses, reduction in the market value and misfortune to farmers. Fungacides such as Dichloronitroanline are used to protect tubers against Rhizopus wet rot (Clark and Moyer 1988). However, the use of synthetic fungicides apart from their potential danger to both the farmer and envirronment (Ogbawu *et al.*, 1997), are unaffordable by most farmers. Recent studies on the use of plant extract have opened a new approach to control of plant diseases. These plant extract have been reported to be safe, non-toxic to man, but effective against plant pathogens (Shivpuri *et al.*, 1997). In Nigeria plant extracts have been used to control fungal diseases of plant such as brown blotch of cowpea (Owolade and Osikanlu, 1999), black sigatoka of banana (Okigbo and Emoghene, 2004), yam tuber rot (Okibo and Nmeka 2005), pea root rot (Abdulaziz and Younes 2010,), and pawpaw fruit rot (Ebele, 2011).

The aim of this study therefore was to investigate the effecacy of using moringa and neem seed extracts for the control of tuber rots of sweet potato, incited by *R. Stolonifer*.

II. MATERIALS AND METHODS

Experimental Site

The experiment was conducted in the Microbiology Laboratory of School of Science Technology, Abubakar Tafawa Belewa University, Bauchi in May 2011. Bauchi town is located at lattitude $10^0$17'N and longitude $9^0$49'E, situated at 609.5m above sea level in the northen guinea savanah ecological zone of Nigeria.

Isolation of *R. stolonifer*

White fluffy fungal mycelia were carefully isolated from decaying bread using cooled flamed inoculation needle and fluffy fungal mycelia were place on solidified malt agar plate and incubated at room temperature (28$\pm$ 2^0C). The organism was sub-cultured by aseptically transfering the fungi to freshly prepared plate of malt agar beginning after 24 hours until pure culture was obtained.

Preparation of plant extracts

Ripe neem (*Azadrachta indica*) seeds were collected underneath of neem trees in fatara district and ripe moringa (*Moringa oleifera*) seeds were collected in Kujuru district of Azare all in Katagun local government area of Bauchi state. The seeds were dried for three days at room temperature (28$\pm$ 2^0C) to reduce moisture content. The dried seeds were ground using blender to get neem and moringa seed powder.

To get concentrated solution of neem and moringa extracts, four lots (30, 60, 90, 120) respectively of the seed powder were dissolved in 1litre of distilled water separately, vigorously agitated and left for 24 hours to stand before filteration. The filterates were used as the plant extractsin the experiment.

Assessment of the Effect of Plant Extracts on *R. Stolonifer*

Fresh, healthy sweet potato tubers were purchased from Wunti Market in Bauchi. These were washed with tap water, rinsed with distilled water and surface sterilized with 60% ethonol. Cylindrical disc of 0.8cm were removed from each tuber with a sterile corkborer. Then a disc of five days old culture of the isolated fungus was transferred into the holes created into sweet potato tubers. Prior to inoculation of pathogen into the tubers, the tubers were treated with plant extracts concentrates and carbendazim and after thirty minnute the tubers were inoculated with pathogen isolates. This is called preventive method of control. Another set of tubers were inoculated with pathogen first and then later treated with plant extracts and carbendazim and this is called curative method of control. Those tubers that are not treated with plant extracts and carbendazim served as the control. The tubers were arranged in a Completely Randomized Design (CRD) with three replications. Each method of control have thirty potato tubers with ten tubers per replicate (four sweet potato for neem concentration, four for moringa concentration one for carbendazim and serving as a cheack making a total of ten tubers per replicate) then times three replications making thirty sweet potato tubers for preventing method and thirty sweet potato tubers for curative control making a total of sixty experimental unit for both methods. The radial growth of the *R. stolonifer* were recorded at interval of 24 hours for ten days. The following data were collected:-

1. Initial weight of potato tuber prior to treatment
2. Initial cut of 0.8cm made before inoculation
3. Daily weight loss at the interval of 24hours for each potato tuber for ten (10) days by subtracting the new weight from the initial weight.
4. Daily radial growth at the interval of 24hours for each potato tuber for ten (10) days by subtracting the new radial increase from the initial using a meter rule

III. DATA ANALYSIS

Statistical analysis of the data was conducted using GenStat Release 72 DE (PC/Window XP) copyright 2007, Lawes Agricultural Trust (Rothemsted experimental station)and treatment means were separated using Duncan's Multiple Range Test (DMRT).

IV. RESULTS

Table 1 shows that the mylicial growth of *R. stolonifer in-vivo* was lower in sweet potatoes treated with neem seed extracts (0.20cm) followed by those tubers treated with moringa seed extracts (0.23), and was lowest in tuber treated with carbendazim, compared with control.

Also varying concentrations of the plant seed extracts significantly ($p \leq 0.01$) differed in reducing the mycelial growth of *R. stolonifer* on infected potatoes (table 2). At 60g/L and 120g/L of neem and moringa seed extracts significantly ($p \leq 0.01$) reduce radical growth of *R. stolonifer* compared with control. However, compared with carbendazim, raqdial growth was significantly higher in the extract treated sweet potato. All the treatmet tasted significantly **(**$p \leq 0.01$**)** reduce radial growth of *R. Stolonifer* compared with the control except moringa seed extracts at 30g/1.

Table 1: The effect of plant extracts on radial mycelial growth of *Rhizopus stolonifer* in vivo

Treatmet	Radial growth (cm)
Moringa seed extract	0.23^b
Neem seed extract	0.20^c
Carbendazim	0.13^d
Control	0.33^a
Level of significance	**
Se$\pm$	0.01

Means with different superscripts in the same colum are significally different.

** = Signifcant at 1%

SE = Standard error

Table 2: Effect of different concentrations of plant extracts on mycelial growth of *Rhizopus stolonifer* on infected sweet potatoes

Treatment	Concentration (g/L)	Radial growth (cm)
Moringa seed extracts	30	0.33[a]
	60	0.25[b]
	90	0.21[c]
	120	0.19[c]
neem seed extract	30	0.24[b]
	60	0.21[bc]
	90	0.19[c]
	120	0.17[c]
Carbendazim	2.0	0.12[d]
Control	0	0.34[a]
Level of significant		**
Se ±		0.01

Means with different superscripts in the same colum are significally different.
** = Signifcant at 1%
SE = Standard error

The result of effect of concentration of different plant extracts and method of control on disease development of wet rot on sweet potato is presnted in table 3. There was a significant ($p \leq 0.01$) difference between those sweet poatatoes tubers treated with varying concentrations of plant extracts compared with those that were not treated under both curative and preventing methods of control. However, disease development was rerduce with icreased concentration of plant extracts under both methods of control. Neem seed extract at 90 and 120g/1 concentration significantlly ($p \leq 0.01$) reduce the disease development and is comparable to the application of 90and 120g/1 moringa seed extract under both method of control. The effectiveness of these concentrations of plant extracts is comparable to carbemdazim at curative method of control.

Table 3: Effect of different concentrations of plant seed extracts and method of control on wet rot disease development on sweet potato.

		Method of control (cm)	
Treatment	Concentration (g/1)	Curative	preventive
Moringa seed extrac	30	0.32[b]	0.26[c]
	60	0.26[c]	0.26[c]
	90	0.21[cde]	0.20[cde]
	120	0.20[cde]	0.19[de]
Neem seed extract	30	0.25[cd]	0.25[cd]
	60	0.24[cd]	0.22[cde]
	90	0.19[de]	0.17[e]
	120	0.17[e]	0.17[e]
Carbondazim	2.0	0.16[e]	0.07f
Control	0	0.14[a]	0.41[a]
Level of signifigcanc		* *	
SE ±		0.02	

Means with different superscripts in the same colum are significally different.
** = Signifcant at 1%
SE = Standard error

Table 4 presented the effect of concentrations of different plant extracts on weight loss of sweet potato infected by wet rot disease. The result showed a significant ($P \leq 0.01$) difference between various concentration of plant extracts. Tubers treated with 30g/1 moringa seed extract did not differ with the untreatrd tubers but differed significantly ($P \leq 0.01$) with other concentrations of plant extracts in reducing weight loss caused by *R.stolonifer* on sweet potato. The effectiveness of moringa seed extract except 30g/1 and the neem seed extract compared effectively with the synthetic fungacide (carbendazim) in reducing weight loss of sweet potato caused by *R. stolonifer*.

Table 4: Effect of concentration of different plant extracts on weight loss of sweetpotato infected by *Rhizophus stolonifer*.

Treatment	Concentration (g)	Weight loss (g)
Moringa seed extract	30	16.26[c]
	60	15.25[ab]
	90	14.93[ab]
	120	14.18[ab]
Neem seed extract	30	15.21[ab]
	60	15.03[ab]
	90	14.83[ab]
	120	14.16[a]
Carbondazim	2.0	13.46[a]
Control	0	16.42[c]
Level of significance		**
Se ±		0.49

Means with different superscripts in the same colum are significally different.
** = Signifcant at 1%
SE = Standard error

Result presented in table 5 showed a significant ($P \leq 0.01$) difference between concentrations of different plant extracts and methods of control on weight loss of potato infected by *R. stolonifer*. Treatment of infected sweet potatoes with 30,60,90,and 120g/1 of moringa seed extract and 90, and 120g/1 of moringa seed extract using any method of control reduced the weight loss of sweet potato due to wet rot disease than the control. The effectiveness of these concetrations is comparable to carbendazim in reducing the damage caused by the pathogen.

Table 5: Effect of concentration of different plant extracts and method of control on weight loss of sweet potato infec90ted by *R. stolonifer*.

		Method of Control(g)	
Treatment	Concentration (g/1)	Curative	Preventive
Moringa seed extrac	30	17.81[ab]	16.85[abc]
	60	16.33[abcd]	15.59[bcde]
	90	14.72[cde]	14.47[cde]
	120	14.36[cde]	14.09[cde]
Neem seed extract	30	15.22[bcde]	15.02[bcde]
	60	14.89[cde]	14.83[cde]
	90	13.96[cde]	13.77[de]
	120	13.11[e]	12.96[e]
Carbondazim	2.0	12.81[e]	12.69[e]
Control	0	18.74[a]	18.47[a]
Level of significance		**	
SE ±		0.69	

Means with different superscripts in the same colum are significally different.
** = Signifcant at 1%
SE = Standard error

V. Discussions

Investigation on the antifungal properties of some plant extracts on the growth of *R. stolonifer* isolate shows that crude plant extracts posses some inhibitory components which cause significant reduction in mycelial growth of the pathogen. Neem seed extract inhibited the mycelial growth of the pathogen as well as weight loss of sweet potato tubers more than the moringa seed extract. This may have resulted from variation in the principle active ingredients in the plant seed extracts. The neem seed extract contain azadrachtin which is known to be fungitoxic against most fungal pathogens. Akpa *et al.*, (1991) reported a significant inhibitory property of neem (*A. indica*) extract on mycelial growth of *Collectotrichum graminicola*, just as Amuchi (1999) found the extract of *Ocimum gratissimum* reduced the radial growth of *Rhizopus spp*.

The effectiveness of plant extracts depends on the nature and amount of active ingredient it contains. Increase in the concentration of the plant extracts correspondingly decreased radial growth of *R. stolonifer* and weight loss of sweet potato. The increased of the concentration of the extract implied an increased in the active ingredients of the solution which acts on fungus there by affecting its physiological processes and consequently lowering the growth of the fungus. The optimum concentration for the control of *R. stolonifer* in-vivo using moringa and neem seed extracts as revealed by this study is 60,

90, or 120g/1. This study has also confirmed and established the antifungal activity of these plant crude extracts, which are interestingly systematic in action and can be used or applied as tuber treatment against wet rots in sweet potato tuber caused by *R. stolonifer*. This agrees with earlier reports of Udo *et al.*, (2001) on the inhibition of growth and sporulation of fungal pathogens on *Ipomea batatas and Dioscorea sp*, by garlic extract; Okigbo and Nmeka, (2005) on the use of *Xylopia aethiopica and Zingiber officinade* to control yam tuber rot caused by *F. oxysporum, A. niger and A.flavus* and Amienyo *et al.*, (2007) on the use of *Z. officinale, Annona muricata, gacinia cola, Alchorniea cordifolia, Allium sativum* to control wet rot on sweet potato caused rot fungal pathogen, Abdullaziz and younes, (2010) on the use of *Cinnamomum verum*, arise (*Pimpinella anisum L.*), black seed (*Nigella sativa L.*) and clove (*Syzygium aromaticum L. Merr and perry*) against pea (*Pisum sativum L.*) root-rot fungus (*Rhizoctonia solani*) and Ebele, (2011) on the use of *Carica papaya, Chronolaena odorota and Acalypha ciliate* on the control of pawpaw fruit rot fungi.

Application of plant seed extracts at varying concentrations reduced wet rot disease under preventive method of control better than under curative method of control. This is probably as a result of the microbes being killed on exposure to the higher concentration of these plant extracts when the inoculum was introduced on the treated parts of the sweets potatoes (i.e, under preventive) which inhibit their ability to establish a nutritional relantionship that will subsequently enable the pathogen to get nourishments or nutrient required for its growth and development. This consequently resulted in reduction in the weight loss of sweet potato caused by *R. stolonifer*. Unlike when the plant seed extracts where used as curative when the pathogen has already established its self and thus the plant extracts may have little effect on the pathogen.

In conclusion, this study has shown that the neem and moringa seed extracts used, have the potentials in the protection of sweet potato plant against rot fungi especially wet rot caused by *R. stolonifer*. Therefore, due to the fact that chemical control of disease is envitronmentally hazardous and very expensive, this inexpensive, non-hazardous and biodegradable plant materials could be used as an alternative way of reducing and controling rot disease by farmers to increase food production in many developing countries, where sweet potato is a staple food for the populace.

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Salisu Abdullahi Bello (2012): Effect of Different Neem Seed formulations for the control of Fruit rot of tomato caused by *Aspergillus spp.* Completed.

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Mus'ab, I.M. (2012): Invitro and In-vivo evaluation of some selected aqueous plant extracts on tomato rot fungi. Completed.

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Maigwaram, U.M. (2014): Effect of Phosphorus level on cowpea scab disease development and yield of cowpea. In view

Edidiong, J. A: Manipulation of some cultural Practices on incidence and severity of Rice blast disease caused by *Pyricularia Oryzae.* In view

Mangshiu, G.B. (2014). Field evaluation of neem and fungicides for the control of late blight disease of potato (*Solanum tuberosum*) coused by *Phytophthora infestans*.

Isma'il, I. A (2014). Field Evaluation of neem seed formulations for the control of late blight disease of potato (*Solanum tuberosum*) coused by *Phytophthora infestans*.

SECTION "I" RESEARCH ACTIVITIES

Swansea/ATBU research linkage/collaborations on use of natural plant products for the control of insect arthropods and pant disease.

SECTION "J" PUBLICATIONS

1. THESIS/DISSERTATION

A. **B. Tech. Agric. Project**

Tijjani, Ahmadu (2005). Effect of Some Plant Seed Extracts on *Rhizopus stolonifer,* a Causal Agent of Wet Rot Disease of Potato

B. **M.Sc. Plant Pathology**

Tijjani, Ahmadu (2011). Effect of some Cultural Practises on Incidence and Severity of Bacteria Wilt of Tomato caused by *Ralstonia solanacearum.*

C**. On Ph.D Plant Pathology**

Tijjani Ahmadu. Studies on microbes associated with tomato fruit rots and efficacy of some plant extracts against four rot pathogens.

II. ARTICLES IN LEARNED JOURNALS

Tijjani, A., Gurama, A.U. and Aliyu M. (2010). In-vitro and in-vivo Evaluation of some Plant Extracts for the Control of Wet Rot Disease of Potato Caused by *Rhizopus stolonifer. Journal of League of Researchers in Nigeria***. II**(2) 45-49.

Tijjani, A., Gurama A.U., Adebitan, S.A., Aliyu, M., Ahmed, B.I. and Fagam, S.A. (2011). Effect of Some Plant Extracts for the Control of Wet Rot Disease of Potato Cause by *Rhizpopus stolonifer. Journal of Environment, Technology and Sustainable Agriculture.* **1**(1):26 – 33.

Adebitan, S.A, A.G. Gaya's, S.G. Haruna, A.U. Gurama and **Tijjani, A. (2011)** Effect of Intercropping Cowpea with Pearl Millet on Incidence and Severity of Downy Mildew Disease Caused by *Sclerospora Graminicola* (SACC). Schroet and on the Yield of Millet.

Adebitan, S.A., Idiok, E.A., **Tijjani, A.,** and Haruna, S.G. (2012). Effect of Intra Row Spacing on the incidence and Severity of Cowpea Scab Caused by *Sphaceloma spp.* and on Cowpea yield. *Nigerian Journal of Plant Protection.* **26** (1):108 – 115

III. CONFERENCE PAPERS

Tijjani, A., Adebitan, S.A., Gurama, A.U., Aliyu, M.,Fagam, S.A. and Haruna, S.G. (2011). Bio-efficacy of some botanicals for the control of wet rot disease on mechanically injured sweet potato caused by *Rhizopus stolonifer* in Bauchi State. Paper Presented at 1st Annual Conference of the

Phytopathological Society of Nigeria held at IITA Ibadan on 25th to 28th October, 2011.

Tijjani, A., Adebitan, S.A.; Gurama, A.U.; Dawakiji, A.Y.; Haruna, S.G. and Safiya, T. (2011). Effect of Some Selected Plant Extracts on *Aspergillu spp,* A Causal Agent of Fruit Rot Disease of Tomato *(Solanum lycopersicum L)* in Bauchi State. Paper presented at 37th Annual Conference of the Nigeria Society for Plant Protection held at University of Agriculture Abeoukuta on 6th – 10th May, 2012.

Adebitan, S.A., Idiok, E.A., **Tijjani, A.** and Haruna S.G. (2012). Effect of Intra Row Spacing on the Incidence and Severity of Cowpea Scab Caused by *Sphaceloma spp.* And on Cowpea yield. Paper presented at 37th Annual Conference of the Nigeria Society for Plant Protection held at University of Agriculture Abeoukuta on 6th – 10th May, 2012.

IV. PAPER BEING CONSIDERED FOR PUBLICATION

Tijjani, A., Adebitan, S.A., Gurama, A.U., Dawakiji, A.Y., Haruna, S.G. and Safiya, T. (2012). Effect of Some Selected Plant Extracts on *Aspergillus spp* A Causal Agent of Fruit Rot Disease of Tomato (*Solanum lycopersicum L.)* in Bauchi State. *Savanna Journal of Agriculture.* **In press**

Tijjani, A., Adebitan, S.A., Gurama, A.U., Aliyu, M.,Fagam, S.A. and Haruna, S.G. (2011). Efficacy of some botanicals for the control of wet rot disease on mechanically injured sweet potato caused by *Rhizopus stolonifer* in Bauchi State. *International Journal of Scientific Research and Publication.* **In press**

Haruna, S.G., Adebitan, S.A., Gurama, A.U., **Tijjani, A.,** and Dawakiji, A.Y., (2012). Invivo Efficacy of Compost Extracts and Time of Application on *Fusarium* wilt (*Fusarium Oxysporum F. sp. Lycopersici)* in Container Grown Tomatoes. *Journal of Bio-science*

Tijjani, A., Gurama, A.U., Adebitan S.A. and Mus'ab, I. (2013). In vitro and In vivo Evaluation of some plants extracts for the control of tomato fruits (Solanum lycopersicum L.) rot caused by *Aspergillus niger*. Journal of Phytophatology and plant health **In press**

V. CONFERENCE ATTENDED/WORKSHOP

(1) The 35th Annual Conference of Nigerian Society for Microbiology (NSM) held at Bayero University Kano on 9th – 13th October, 2011.

(2) The 36th Annual Conference of Nigerian Society for Plant Protection held at Federal University of Technology Akure, on 4th – 8th September, 2011.
(3) The 1st Annual conference of the phytopathological society of Nigeria held at IITA Ibadan on 25th – 28th October, 2011.
(4) The 25th Annual Conference of the Farm management Association of Nigeria (FAMAN) held at Federal College of Agriculture, Akure on 5th – 8th September, 2011.
(5) The 37th Annual Conference of Nigerian Society for Plant Protection held at Federal University of Technology Akure, on 6th – 10th May, 2012.
(6) The 46th Annual Conference of the Agricultural Society of Nigeria (ASN) held at Bayero University Kano, Kano on 5th – 9th November, 2012

WORKSHOP ATTENDED

(1) International Workshop "on the use of natural plant products for the control of insect arthropods and plant diseases" held at Muhimbili University, Dar-essalam, Tanzania on 22nd – 28th July, 2012 organized Swansea University in Collaboration with Abubakar Tafawa Balewa University, Nigeria, Kenyata University, Kenya and Muhimbili University.

SECTION "K" COMMUNITIES SERVICES

— Tutor in Katagum Student Association Tutorial Programme Azare
— Member, Bakin Kasuwa Mobilization Association Azare.
— Tutor Markazul Islam, Institute of Arabic and Islamic Studies Azare.
— Member, Yelwa Lebura Community Development Association Bauchi.
— Member, National Union of Bauchi State Students, ATBU, Branch Bauchi.

SECTION "L" REFEREES

1. **Prof. Isyaku Muhammad**

   Dean, School of Agriculture and Agricultural Technology ATBU, Bauchi.
2. **Prof. S.A. Ibrahim**

   Dean School of Agriculture and Agricultural Technology ATBU, Bauchi.
3. **Prof. S.A., Adebitan**

Professor of Plant Pathology School of Agriculture
And Agricultural Technology ATBU, Bauchi.