RESEARCH TRENDS IN INTEGRATED MANAGEMENT OF MAJOR CACAO DISEASES AND FUTURE PROSPECTS IN NIGERIA

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Introduction

- *Theobroma cacao* is the most prominent foreign exchange earning crop in West Africa which produces over 70% of the annual total World production.
- In Nigeria, it's second to petroleum but 1st among Agricultural produces.

Introduction

- Cacao suffers severe losses to pests & diseases (Bartley, 2005)
- Black pod, (*Phytophthora megakarya & P. palmivora)*
- CSSVD (Cocoa Swollen Shoot Virus)
- Root-knot nematode (*Meloidogyne incognita*)

Introduction

- *Phytophthora* pod rot is the most important disease of cacao in West Africa. (Bowers *et al*, 2001).

- 100% pod losses is reported in some areas (PAN 2001, Agbeniyi and Adedeji, 2003).

A typical cocoa pod infected with black pod disease (a=whitish spores of *Phytophthora megakarya*)

Introduction

- Fungicides spray, the most effective control (Purdy and Schmidt, 1996).
- Regular outbreaks despite fungicides spray (Agbeniyi and Adedeji, 2003).

Introduction

- CSSVD causes decline of cocoa production in Ghana & Nigeria years past (Dongo and Orisajo, 2007)
- 1st noticed in 1935, lead to establishment of (WACRI) West African Cocoa Research Institute(Opeke, 2003)

Ravaging impact CSSVD

- The virulent strains cause various types of leaf chlorosis, root necrosis, swellings on branches and twigs
- With greater development of phloem and xylem, followed by die-back in Nigeria (Dongo and Orisajo, 2007)

Control measures

- To removal of affected plants
- Selection for Tolerant and Resistant hybrids
- Screening of safe pesticides for controlling insect vectors

Ravaging impact of Root-knot Nematode

- Root-knot nematode (*Meloidogyne incognita*) causes yield decrease, sudden death and retardation of seedling growth (Campos & Villain, 2005)

Control measures

- Soil amendment with poultry litters
- Combination of carbofuran and poultry liters

Ravaging impact of major cacao diseases (2)

- The pathogen, CSSV spread from tree to tree
- By mealy bugs, over 8 species transmit the virus
- *Planococcoides njalensis* (Laing) and *Planococcus citri* are the most important mealy bug vectors
- There are many strains of the virus in Nigeria
- And differ in the symptoms they produce
- The virulent strains cause various types of leaf chlorosis, root necrosis, swellings on branches and twigs
- With greater development of phloem and xylem, followed by die-back in Nigeria (Dongo and Orisajo, 2007)

Efficacy of pesticides

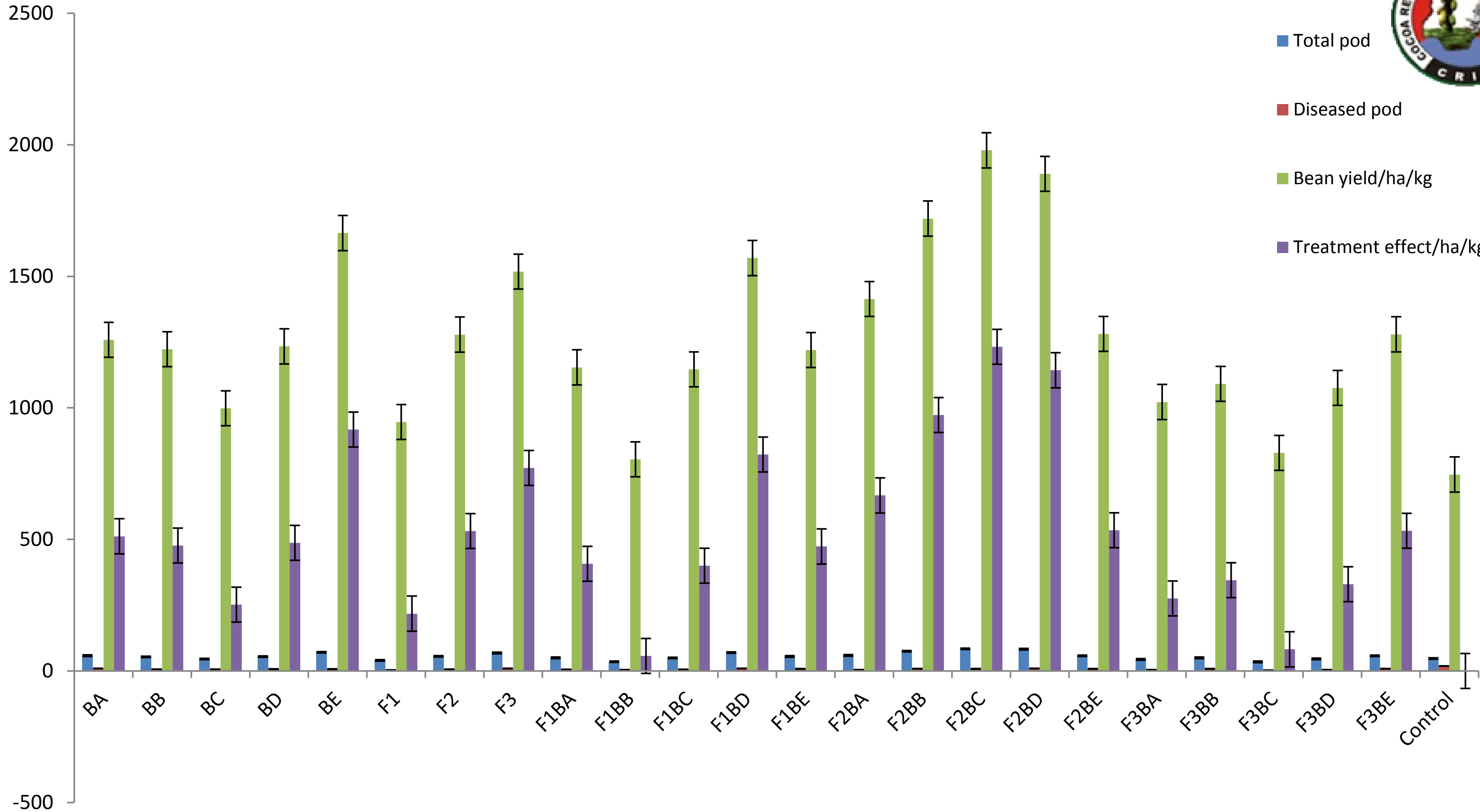
- Contact or systemic which are copper, metalaxyl and metalaxyl – M based fungicides
- Have resulted in reduction of incidences of black pod disease & increase cacao production in Nigeria
- Copper hydroxide, Cuprous oxide + metalaxyl-M, Cuprous oxide, Copper hydroxide + metalaxyl and Cuprous hydroxide have been screened by CRIN to test their efficacy on – station and on – farm trials
- Currently being screen are: Pyraclostrinbin (69g) + Dimetomorph (38g), Copper (1) oxide (60%) + metalaxyl 12% and Mandipropamid (125g) + Mefenoxam (100g)

Problems and hazardous effects of pesticides

- Resistance of the pathogen (Fontem *et al.,* 2005)
- Runoff from heavy rainfall and water pollution.
- Abuse by ignorant farmers
- Residual effects

Development and Prospects of IPM for Cacao

- Researches have demonstrated the efficiency of *Trichoderma* strains (Adedeji et *al.,* 2005, 2007 and 2008)
- Studies have also compared the efficacy of BCA – *Trichoderma* strains (NIG-T287, NIG-T288, NIG-T289, NIG-T290 and NIG-T293) along with common active ingredients use on cacao
- Economic viability , improved cacao production.
- Cuprous oxide + metalaxyl, metalaxyl-M, Copper (II) Sulphate Pentahydrate and Copper Hydroxide were tolerated by BCAs *in vitro*
- Field trials along and in combination with the BCAs were demonstrated



: EFFECT OF TREATMENTS ON POD YIELD PARAMETERS

*BA = NIG-T287 F2BA = FUNGURAN OH + NIG-T287; BB = NIG-T288 F2BB = FUNGURAN OH + NIG-T288; BC = NIG-T289 F2BC = FUNGURAN OH + NIG-T289; BD = NIG-T290 F2BD = FUNGURAN OH + NIG-T290; BE = NIG-T293 F2BE = FUNGURAN OH + NIG-T293; F1 = RIDOMIL GOLD F3BA = COPPER SULPHATE +NIG-T287; F2 = FUNGURAN OH F3BB = COPPER SULPHATE +NIG-T288; F3 = COPPER SULPHATE F3BC = COPPER SULPHATE +NIG-T289; F1BA = RIDOMIL GOLD + NIG-T287; F3BD = COPPER SULPHATE +NIG-T290; F1BB = RIDOMIL GOLD + NIG-T288 F3BE = COPPER SULPHATE + NIG-T293; F1BC = RIDOMIL GOLD + NIG-T289 CONTROL = UNSPRAYED STANDS; F1BD = RIDOMIL GOLD + NIG-T290; F1BE = RIDOMIL GOLD + NIG-T293. ADEDEJI *ET AL.,* (2010).

Effects of poultry litter and carbofuran soil amendments on the growth of cacao in the field naturally infested with plant-parasitic nematodes

Treatments	Plant height[1] (cm)	Stem girth[1] (cm)	Number of Branches[1]	Number of Leaves[1]	Leaf area[1] (cm^2)
PL at 0.4t/ha	252.3a	4.38a	33.8a	342.8a	246.3a
PL at 0.4t/ha + C at 2.50kg a.i./ha	252.7a	4.39a	32.3a	341.7a	246.7a
PL at 0.4t/ha + C at 1.25kg a.i./ha	253.3a	4.39a	32.8a	340.8a	246.3a
PL at 0.3t/ha	228.7c	3.98c	24.3b	256.3b	224.3b
PL at 0.3t/ha + C at 2.50kg a.i./ha	234.0b	4.03b	24.3b	257.0b	224.3b
PL at 0.3t/ha + C at 1.25kg a.i./ha	234.7b	4.05b	25.0b	257.0b	224.7b
PL at 0.2t/ha	157.0d	3.15d	19.7c	154.0c	143.7c
PL at 0.2t/ha + C at 2.50kg a.i./ha	155.3d	3.17d	19.7c	152.3c	143.7c
PL at 0.2t/ha + C at 1.25kg a.i./ha	155.3d	3.12d	19.7c	152.7c	143.3c
C at 2.50kg a.i./ha	131.7e	2.90e	12.0d	105.0d	120.3d
C at 1.25kg a.i./ha	101.3f	2.10f	6.8e	67.3e	91.7e
Control	79.7g	1.81g	4.3f	44.0f	66.7f

Figure 4: Dieback conditions of cacao seedlings in the field caused by plant-parasitic nematodes 8 weeks after transplanting (A) compared to plant in plot amended with poultry litter (B)

- A

- B

Figure 5: Sudden death of cacao seedlings in the field caused by plant-parasitic nematodes 12 weeks after transplanting (A) compared to plant in plot amended with poultry litter (B)

- A

- B

Managing Cocoa Diseases Using Cultural Practices

- Cultural practices are simple to apply both for cost and environmental conservation
- Phytosanitation is an important cultural method
- Complete removal of diseased plants/parts of the tree

Future research and policy to enhance integrated management of cacao diseases

- Hybridization of strains of *Trichoderma* is required to combine beneficial characteristics
- Mass production of BCAs and formulation into pellets
- Field trials of new active ingredients in combination with BCAs
- Molecular characterization of *Phytophthora, Trichoderma* and Nematode species in growing regions of Nigeria
- Development of IPM package botanical species, BCAs & pesticides against cacao diseases

Future research and policy to enhance integrated management of cacao diseases

- Development of bio-pesticides to combat cacao diseases
- Production of Tricho-composts and formulations for cacao nursery and field diseases
- Breeding for more disease resistant varieties of cacao
- Development of curriculum in cocoa phytomedicine for faculty of Agricultures and Colleges of Agriculture to be packaged and run by Universities and CRIN
- Provision of enabling environment & encouragement for research on cocoa
- As an important foreign earning crop for West Africa

Conclusion

- Integrated cocoa disease management stresses reliance on preventive practices
- And balances the strengths of one practice against the weaknesses of another
- To provide a more complete or holistic disease management approach
- Responsible pesticides usage is advocated only if the preventive practices fail
- IPM reduces concern about pesticide residue and contamination of cocoa beans
- There will be access to safe and quality cocoa for the production of chocolate.

Thanks for your attention