ALL WELCOME

Which tomatoes do you prefer?

(A) From hydroponic farm at Sogeri Primary Producers in Port Moresby

(B) From a village farm displayed at Kokopo Main Market

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Would the controversial transgenic crops be beneficial to the economy of Papua New Guinea?

This is a Review of the current trends and future implications.

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Presentation outline

- Introduction
- Current trends in PNG
- Genetically modified crops
- Brief review of genetically modified crops
- Nature of crops in PNG
- Future implications
- The approach
- Conclusion
- Acknowledgement
- References

Photo: *GMOs nutritious httpadrianaortiz.weebly.com*

Introduction


Photo: Sogeri Primary Producers

- What is a transgenic crop or genetically modified crop (GMC)? Definition of GMC.pptx . Why is it important?
- GMCs playing a pivotal role in food security and economy of many countries with most includes the developing nations worldwide (Apted *et al*., 2005; Bohorova 2010),
- Biosecurity issues on GMCs remain controversial in PNG and elsewhere in the world. What is the current status of PNG on this matter?
- Do we need GMCs and GMOs? How much do we know about them?
- What would be the future of food security in PNG after 100 years?

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…con't introduction

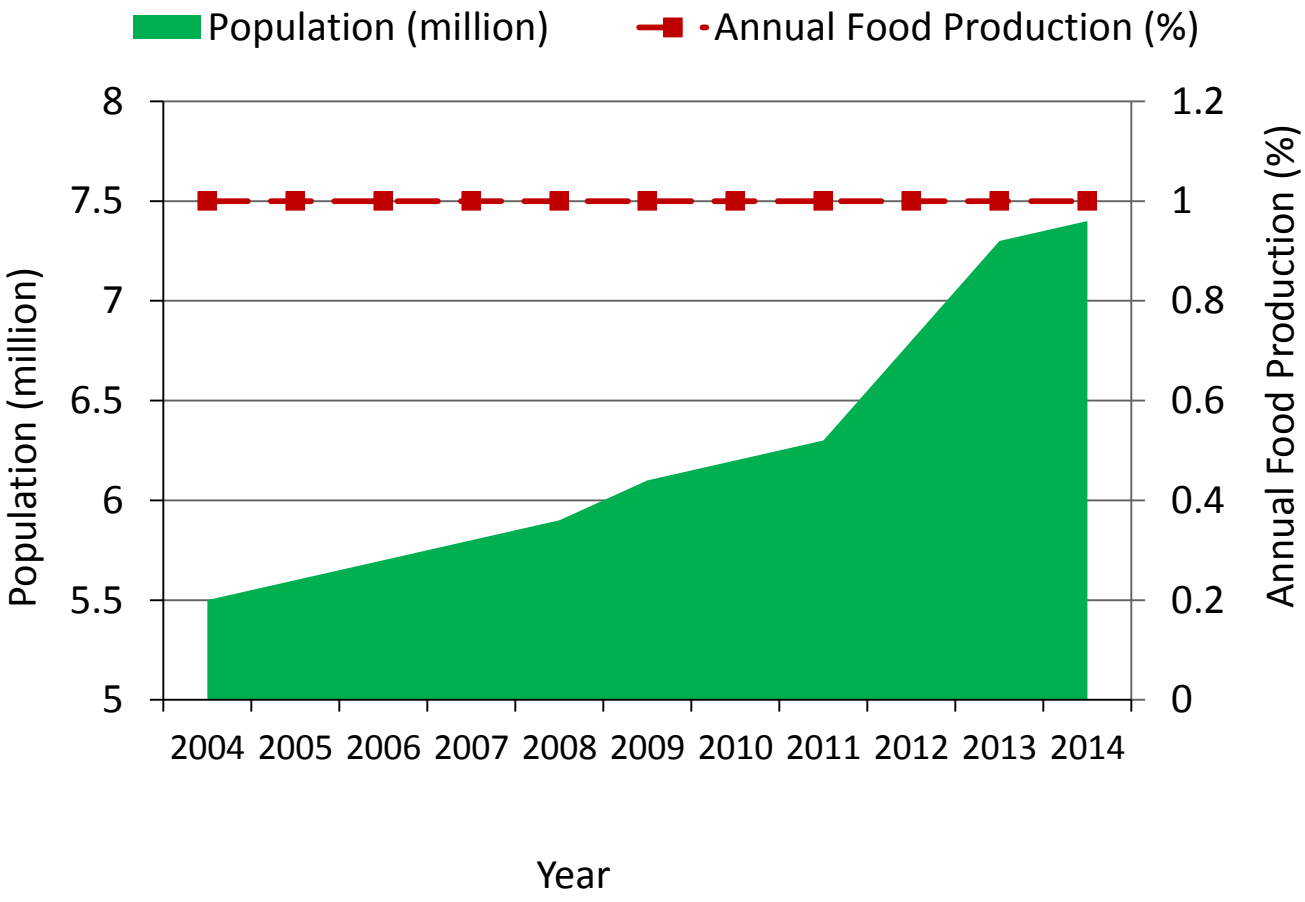
- Food production in PNG comparatively does not equate the population growth due to rural-urban drift among other reasons.

- Current food production rate of PNG stands 1% every year. So what would it be like in 100 years?

- This review analyses major socioeconomic trends and potential use of GMCs given needs on food security and agri-based economy against rapid growing population in the LNG era.

Current trends in PNG

1. Population growth Vs food security



Source: *World Bank 2011; Gibson 2001.*

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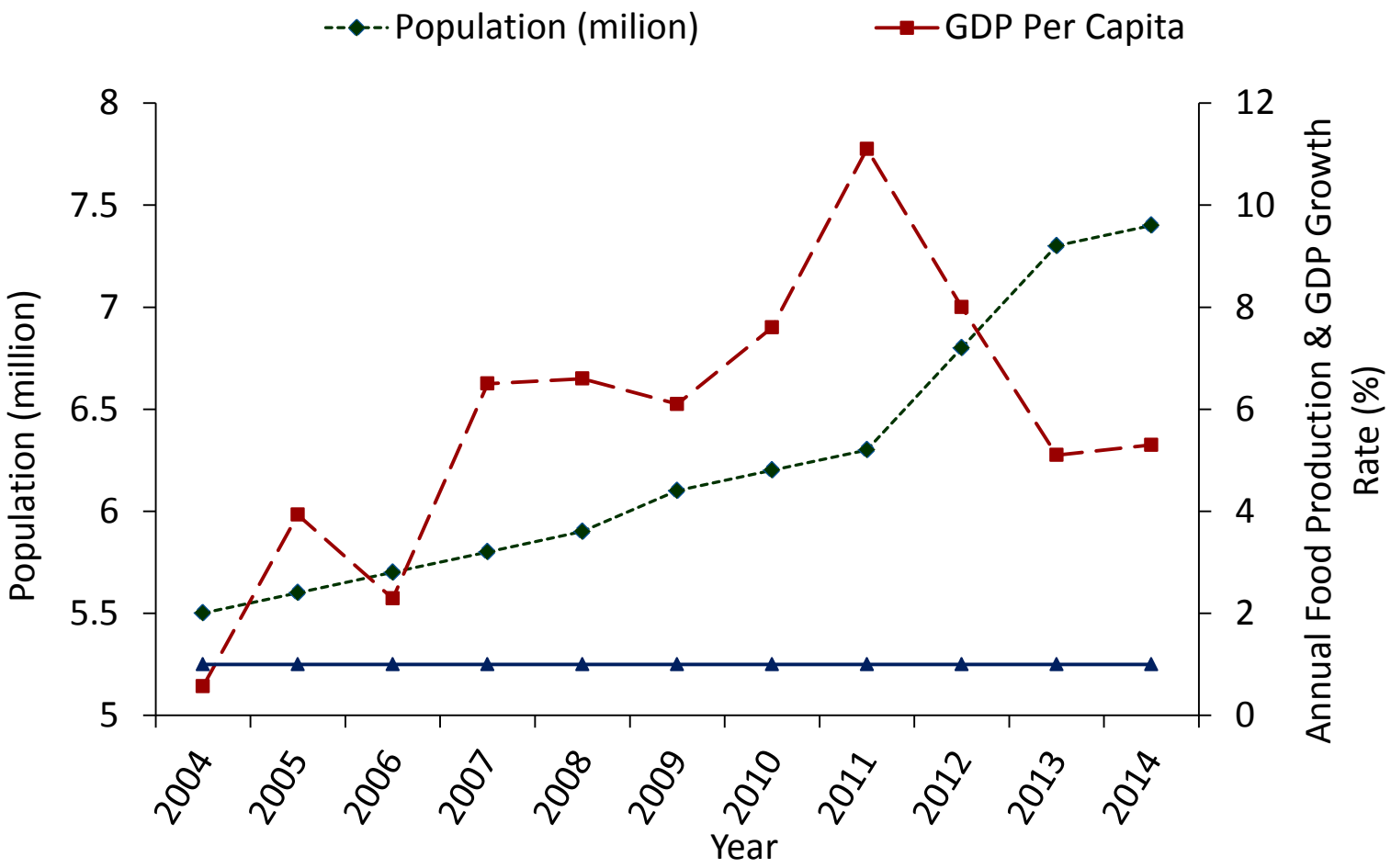
II. Economy Vs growing population



Source: *World Bank 2011; Trading Economics 2013*

III. Impact of climate change on PNG agriculture

Frequent floods and erosions

Prolong drought

Rise in sea level

Emergence of new pests and diseases

Genetically Modified Crops in PNG

I. Existence of Transgenic crops in PNG?

- GMOs including GMCs, either processed or raw, have arrived in PNG (Biosecurity Framework, 2005). Are these GMCs.pptx
- Globalization increases chances for GMO smuggling
- GMCs may have been cultivated elsewhere in PNG un-noticed (exact number is not known).

II. How effective are GMOs/GMCs regulated in PNG?

- Biosafety Framework 2005 and Biosafety and Biotechnology Policy 2000 is assumingly functioning well.
- GMO monitoring efforts made at main ports may have lost focus or compromised if what was being reported by Biosafety Framework (2005) has been true.
- State mandated departments/organisations (e.g. UNITECH) need greater input on monitoring and regulating GMOs/GMCs.
- Institutional and technical capacity need improvement - both for regulation and development of new crop varieties or other GMOs.

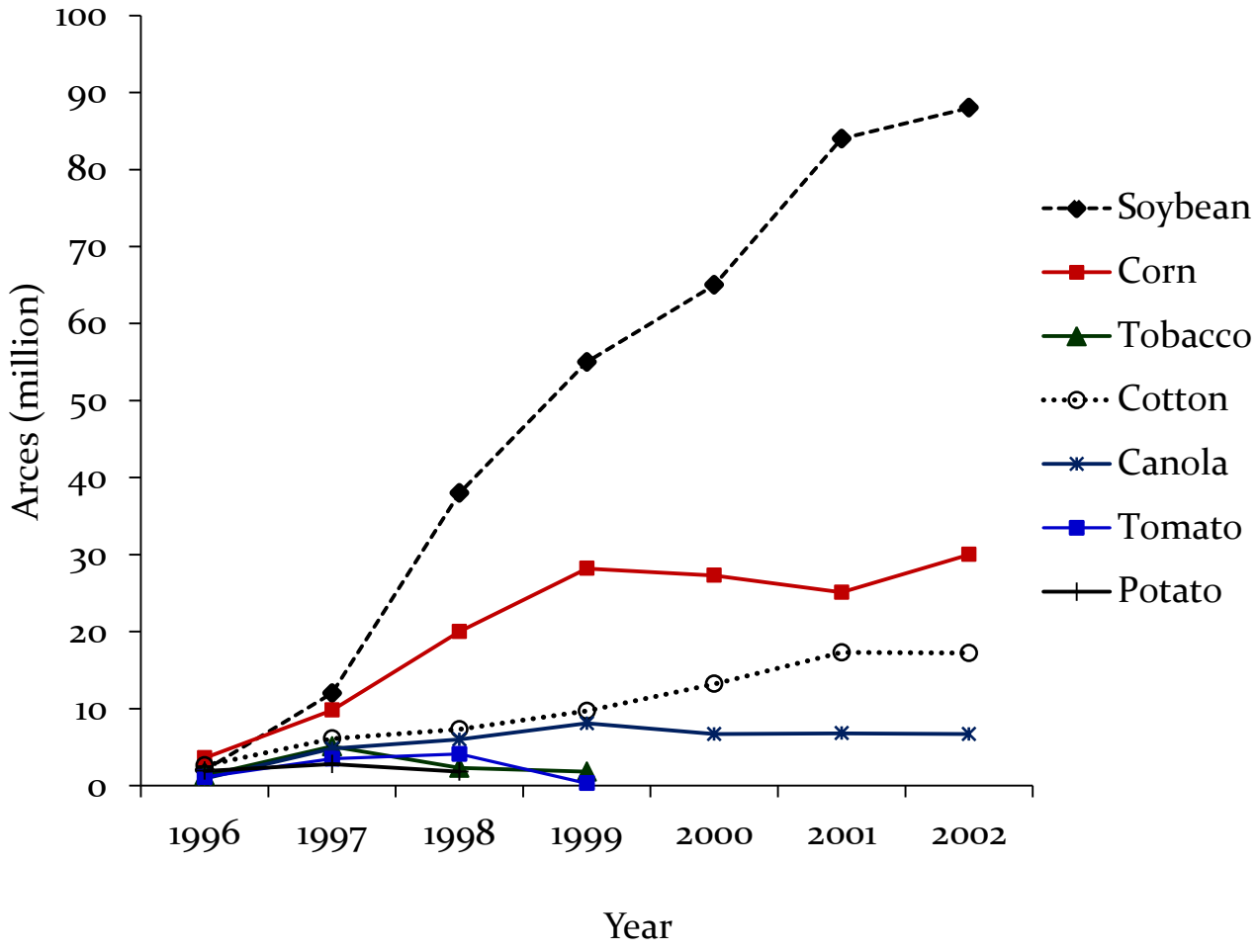
World Adoption of GM Crops: Review

I. Adoption of transgenic varieties

Table 1. Some of the globally cultivated transgenic crops.

Transgenic crop	Problem	Trait	Source
Bt Cotton	-boll worm -aphid -larvae	pest resistance	Toenniessen et al. 2003 Farre et al. 2010
Bt Soybean	-weed	herbicide resistance	Bonny 2011
Bt Eggplant	-pest	pest resistance	Kolady et al.
Bt Maize	-corn borer	borer resistance	Bohorova et al. 2001 Mercer et al. 2012
Bt Rice	-common rice pests -rice disease	pest resistance	Balachandran et al. 2003 Tu et al. 2000
Bt Sugarcane	-borer	borer resistance	Bohorova et al. 2001

II. Trend of impact by Transgenic crop on global economy



Others include; Maize, rapeseed ..plus 100 crop varieties in more that 80 countries: GMO cultivating countries.pptx

Source: Data from James 1997, 1998, 2003

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III. GMCs Vs health and environment

Benefits:

- Reduced expensive, toxic and persistent chemicals – reduces infiltration and poisoning water sources
- Improves land use efficiency (would benefit highly populated areas due to swamps, rugged terrains, mining and intensive agricultural activities)
- Adaptation to changing climatic conditions.

IV. GMCs Vs health and environment

Risks:

- GMO risk on human health and environment is a grave concern
- No evidence to substantiate GMO risks on human or environment
- Fear: transfer of one or more gene from unrelated organism might produce toxins or allergens in food we eat.
- Risk assessments are not always intended to demonstrate “zero risk” because every food we eat is unsafe in nature.
- All foods are contaminated or can cause side effect if taken more than enough. E.g., eating 1-2 carrots is less harmful than 10Kg

Potential Areas for GMC use on PNG crops

I. Local landraces (food crops)

Table 2. Some of the common problems in local foods of PNG.

Landrace	Rural	Urban	PNG	Problems	Source[1]
Sweet potato	65.0	33.6	60.2	-Sweet potato weevil	Kokoa 2006
Taro	14.4	74.6	23.5	-Taro beetle, -Taro leaf blight	Masamdu and Simbiken 2000 Kokoa 2006
Sago	23.9	9.6	21.7	-Palm weevil	PestNet 2015
Yam	12.5	4.8	11.3	-Anthracnose disease	Gunua and Gendua 2000
Cassava	6.9	4.3	6.5	-Cassava mosaic disease	Gunua and Gendua 2000
Banana	33.6	38.7	34.3	-Fusarium wilt (Panama disease)	Davis et al. 2000
Sugarcane	24.3	3.1	8.2	-Sisamia stem borer	Kuniata et al. 2006
Papaya	5.1	2.7	5.3	-papaya fruit fly	Simbiken 2006
Mango	6.2	3.4	7.3	-Red-banded mango caterpillar	Tenakanai et al. 2006
**Others	5.6	7.8	4.3	-Various pests and diseases	-

[1] Reports of researches conducted in Papua New Guinea

* Case reported recently.

** Includes more than 30 species of fruit trees, 10 species of vegetables, 14 species of root/tuber crops.

II. Status of Introduced food crops – are they GMCs?

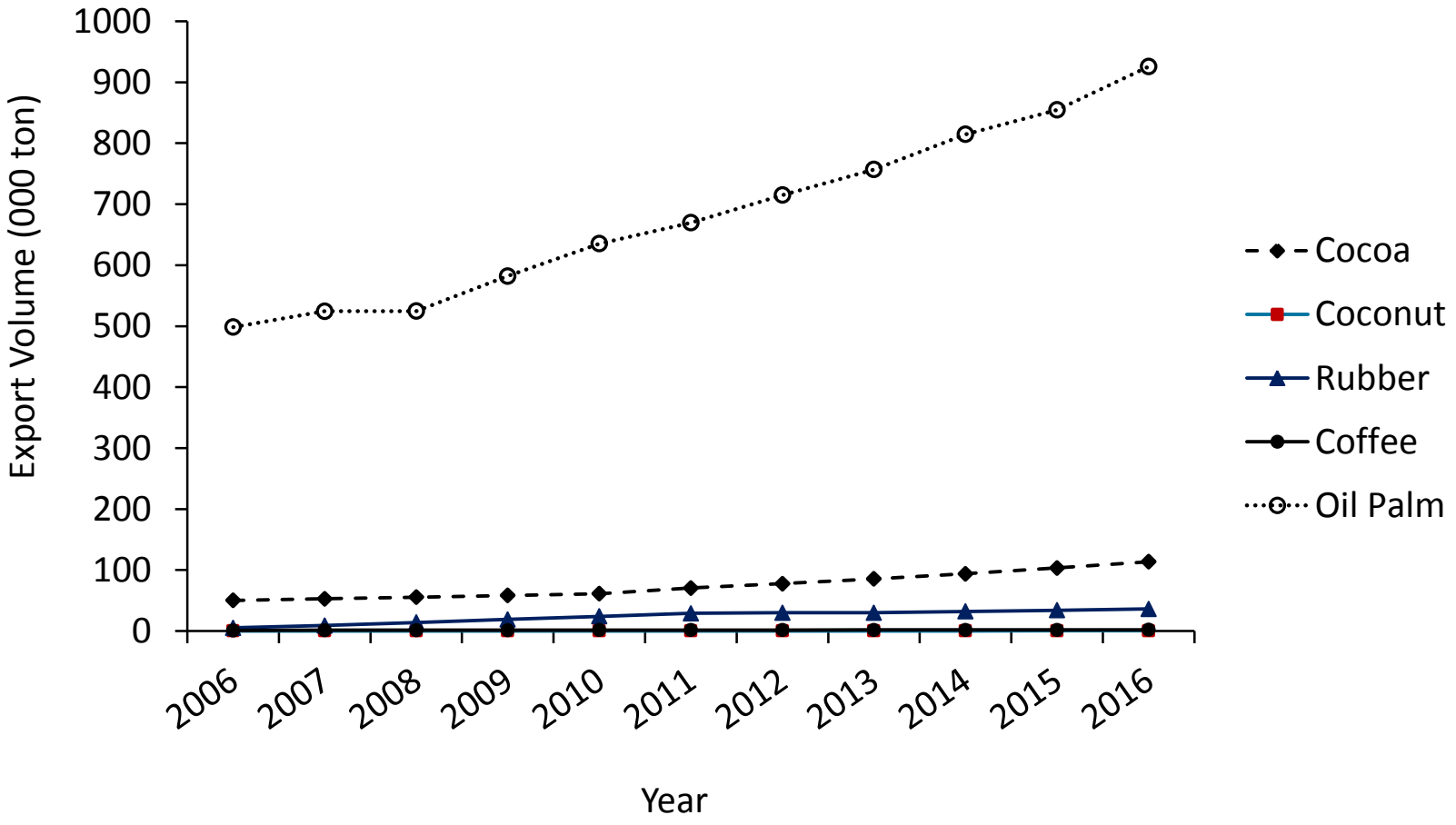
Table 3. Proportion (%) of population consuming introduced foods in Papua New Guinea (Gibson et al. 1991).

Introduced crop	Rural	Urban	PNG
Head cabbage	65.8	92.1	88.3
Rice	25.8	87.4	35.1
Irish potato	2.3	5.4	12.2
Maize (corn)	1.2	3.1	2.4
Chinese taro	0.3	0.9	0.4
Broccoli	8.7	13.1	6.7
Cauliflower	2.3	4.1	1.9
Carrot	3.6	7.6	5.2
Spring onion	1.3	6.3	7.3
Bulb onion	0.6	6.7	4.3
Capsicum	0.2	4.6	3.6
Tomato	0.3	4.2	3.6
Letuce	0.4	3.6	2.9
Pea bean	0.6	3.1	2.8
Pumpkin	2.3	3.4	2.1
Chinese cabbage	3.5	4.1	2.9
*Others	5.6	7.5	6.7
* Includes more than 30 species of fruit trees, 10 species of vegetables, 14 species of root/tuber crops			

Potential for GMC use on Commodity Tree crops

Table 4. Major problems associated with some of the commercial crops in Papua New Guinea		
Tree crop	**Persistent pathogenic problems**	**Source[1]**
Cocoa	-Cocoa pod borer (CPB)* -Phytopthera pod rot -Monestera weed	PNGCCIL Annual Report 2006 McGregor 1981 Yinil 2006
Coconut	-Coconut beetle -Coconut inflorescence borer -Bogia Coconut Syndrome (BCS)*	Gende et al. 2006 Kakul et al. 2006 PNGCCIL Annual Report 2010
Oil palm	-Sexava and Basal stem rot	Caudwell 2000
Coffee	-Coffee berry borer and coffee berry disease	Simbiken 2006
Sugarcane (commercial)	-Ratun stunning disease -Sisamia stem borer	Waller et al. 1987 Kuniata et al. 2006
[1] Reports of researches conducted in Papua New Guinea * Recently reported case		

Tree Crops



Source: Data from: PNG NADP, 2007)

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Potential future implications

- Population is increasing against decreasing land and food production.
- High population density areas are vulnerable to increasing food demand, better nutrition, water and space.
- Climate change scenarios contribute to decreasing agricultural land and increase food demand.
- Developing a sustainable economy starting today will bring PNG forward after 100 years of oil and gas.

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The Approach

- Specific food and industry crops need to be identified and improved using transgenic technology (TT).
- Conventional crop improvement strategies incorporated with TT to relieve burdens on cost and environmental risks.
- National biosecurity guidelines foster strict regulations on food imports while promoting national interest on improving and developing own products.
- Improve GMO monitoring and surveillance exercises at all check points through to farmer.

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Conclusion

- Increasing population need more food, nutrition, water and space to survive, so PNGs economy should have enough room to accommodate this growth in demand.
- PNG's 7.2mil people consuming around 21mil plates of food per day supported only by 100 000 farmers nationwide. What would it be like in 100 years?
- The plan to develop a sustainable economy during the LNG era starts today to see its impact after oil and gas are depleted.

Acknowledgement

This debate is probably the first of its kind to be discussed and it is expected to draw critics challenging this long due controversial issue. We value and appreciate all critical comments and suggestions from within and outside PNG UNRE community.

Photo: Courtesy of Mr. Taisa

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Tenk yu olgeta!

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