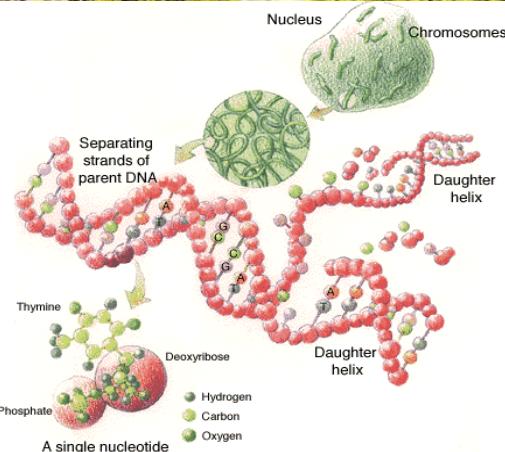


# The increasing roles of PPPs in Developing Countries



Denis J Murphy  
University of Glamorgan, UK

# The Green Revolution



**Dwarf cereal plants developed by breeders in 1950-70 have higher yields, do not topple, and respond well to fertiliser**



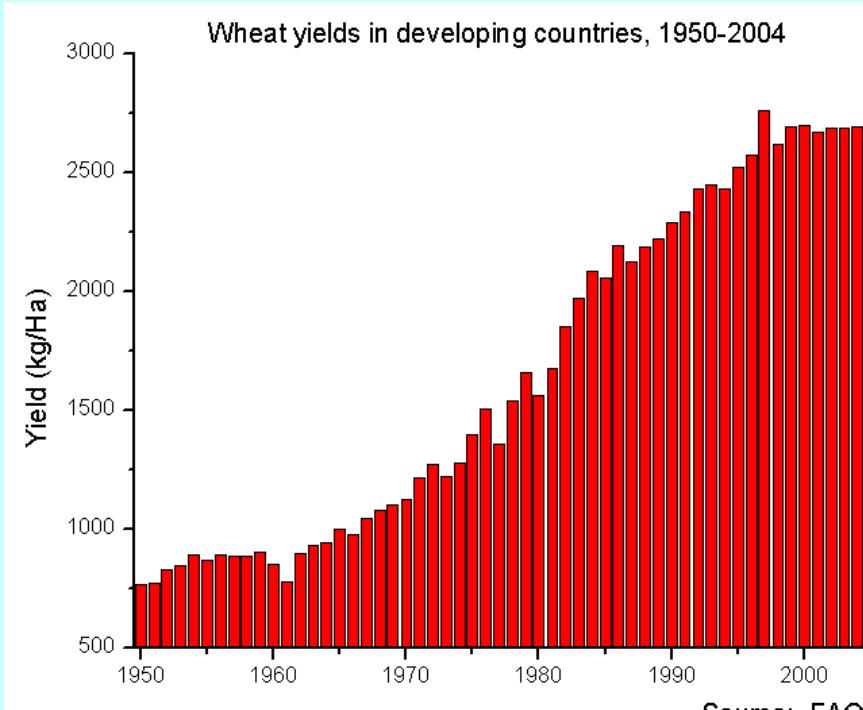
**Norman Borlaug, Nobel Laureate, 1970**

**Dwarf wheat**

**Tall wheat**



© Denis J Murphy 2009



Source: FAO

# Some major public sector-led breeding successes

- NERICA, inter-specific hybrid *O sativa* X *O glaberrima* (wide cross, embryo rescue) WARDA
- Disease resistant rice, inter-specific hybrid *O sativa* X *O nirvana* (wide cross, embryo rescue) IRRI
- Hybrid rice, intra-specific hybrid with strong heterosis – feeding extra 75M people/yr (MAS, extension) China
- Vitamin A sweet potato & cassava (μpropagation) Africa
- Mutation breeding: 2770 crops/varieties Global

# Biotechnological tools

## Advanced breeding technologies

- Transgenesis (genetic engineering or GM)
- Mass clonal propagation
- Hybrid creation
- DNA marker assisted selection
- Genomics
- Mutagenesis/TILLING

These technologies have created unprecedented opportunities for advances in the biological performance of food crops

But some key technologies/expertises reside within, or are best exploited via, the private sector – **hence the increased need for PPPs**

# **Oil palm – a key global crop**

**The major edible oil crop in the world**

**Biggest markets are in Asia**

**Major cultivation centres: Indonesia, Malaysia, S America**

**Grown by 2 million smallholders**

**High environmental impact – especially when pristine land converted to plantations**

**Both large producers and smallholders can and should be part of solution to current problems with OP**

**Requires a multi-pronged approach including PPPs**

# Oil palm – the yield problem

## Palm oil yields stagnated for many years now

*The Star*  
27 July 06

ARE we ready to capitalise on the expected increase in palm oil prices? The answer is a sad "no" simply because our palm oil yields had stagnated for so many years.

While some of the private-sector plantations have made some progress in closing the yield gap with good management practice (GMP) and good agricultural practice (GAP), there is still a lot of room for improvement.

This lamentation, which has been repeated so often either at national- or international-level conferences yearly, is another wake-up call to the planting fraternity to resolve the yield-stagnation issue quickly.

While Malaysia is the No. 1 exporter of palm oil in the world, we cannot similarly claim to be the most efficient producer, as we have thus far achieved only 55% to 60% of the targeted eight tonnes of palm oil per hectare.

There are many "whys" the planting fraternity must answer on our yield stagnation.

The best persons to provide the answers would be the estate manager (EM) and the chief executive officer (CEO).

The EM is the implementer of the daily field operations to achieve the best yields and the CEO is the policy maker to provide guidance and support to the EM to attain this achievement with the researchers and others from head office playing a supporting role.

Basically, everyone has a role to play to ultimately assist the EM to produce the best yields as his primary concern is to ensure that the oil palms produce the highest number of bunches.

There is also another big question on why expand when we have not managed and tapped the full potential of land productivity on our existing plantations within our shores. We have the experience, expertise, books, knowledge from articles, conference proceedings written by senior planters and researchers who have come and gone and existing planting materials capable of producing 40 tonnes of fresh fruit bunches or more and yet, we still have yield stagnation.

Basically, we, being in the industry for so long, know what needs to be done to close the gap i.e. managing our human resources to bring out their best to excel in whatever they do to achieve the desired result by putting in the GMP and GAP.

This is easier said than done. The important point is we can get it done; and we must if we want to sustain our business on our existing land within our shores for many years to come for the betterment of our nation and future generations.

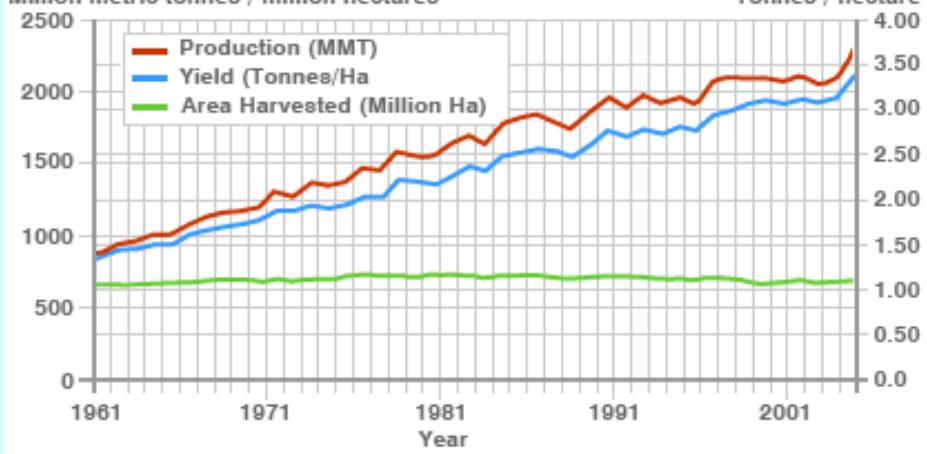
A PRACTICAL PLANTER,  
Subang Jaya.

Malaysia Palm Oil Yield  
Actual and Forecast



### WORLD CEREALS PRODUCTION AND YIELDS

Million metric tonnes / million hectares



SOURCE: UN Food and Agriculture Organization

# The yield issue



**Soybean/Canola/Sunflower:  
0.5 T/ha**



**Oil palm: 3 to 10 T/ha**

**Potentially < 20 T/ha**

# Getting from A to B

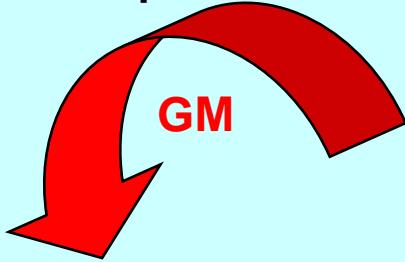
A —————→ B

Low yield semi-improved OP

New high yield improved OP

**How do we do it?**

Genes from  
other species



# Getting from A to B

A

Low yield semi-  
improved OP



Genes from OP  
accessions

## Biotechnologies for OP improvement

F1 hybrids

Mass propagation

Genomics

Mutagenesis/TILLING

Genetic engineering (GM)

B

New high yield  
improved OP

Genes from  
other species

# Getting from A to B

GM

## Some target traits/genes

- Height
- Oil yield
- Oleic acid
- Lipase
- Disease resistance
- Stalk length
- High vitamin A, E

A

Low yield semi-improved OP

Non-GM

Genes from OP accessions

## Biotechnologies for OP improvement

- F1 hybrids
- Mass propagation
- Genomics
- Mutagenesis/TILLING
- Genetic engineering (GM)

B

New high yield improved OP

Genes from  
other species

# Getting from A to B

GM

These targets will be most efficiently achieved via PPPs and NSPs, while maintaining local ownership of key technologies and bioresources

Low yield  
improved

3

High yield  
ed OP

Disease resistance

Stalk length

High vitamin A, E

Mutagenesis/TILLING

Genetic engineering (GM)

Genes from OP  
accessions

Non-GM

# Facilitating PPPs

- Plantation companies have input into public R&D (**PAC**)
- Plantation companies also do their own R&D (**μprop**)
- Public sector outsources aspects of R&D to local & international hi-tech service providers (**genome sequencing/informatics**)
- Public sector works with SMEs to commercialize R&D (**Bt spray, hi-value antioxidants**)
- Public sector mediates with global community on topics such as GMOs and environment/sustainability agendas

# Improving crop management

- It can be a major challenge to translate biological improvements into reality on all plantations (commercial & smallholder)
- Management of plantations – disseminating best practice, improving extension services, re-skilling labour force
- Implementation of best practice in propagation, husbandry, harvesting, and processing of the crop
- Underperformance in this area is shown by the relative stagnation of average plantation yields at well under 4 t/ha over the past 15 years
- This is despite the development of much higher-yielding genotypes and their effective cultivation by some of the more exemplary growers.

# Engaging the private sector

- Should be a key aspect of the mission of public sector R&D bodies
- Private sector includes small and large farmers, service providers, middlemen, food processors, retailers etc – all of whom are stakeholders in agriculture
- Encourage entrepreneurship by R&D providers – including public sector (where appropriate)
- Exchange staff via public/private secondment schemes

# Conclusions

- In order to confront the challenges of 21<sup>st</sup> century agriculture, breeders need to use all available tools and modalities of crop improvement/management
- Many private sector technologies are providing new tools for crop improvement
- The private sector can also benefit from public sector involvement in opening up new markets and in facilitating dialogues with global bodies
- PPPs are best viewed as win-win enterprises that are relevant to all sectors and scales of agriculture from global multinationals to small farmers and local SMEs

# **Thank you for your attention**