Plantation Irrigation- vital for African, LATAM & ASEAN Agriculture

Across the world erratic weather patterns are pressurising the key plantation sector just when the industry was making such good progress with traceability, winning valuable backing to expand production in the face of growing demand. Drought related productivity issues have not yet been acknowledged as everyone is effected and aside from expensive fossil fuel powered schemes there is no known solution. So how can this sector grow despite the challenges?

Recognise the danger from erratic and extreme weather patterns- weather is clearly having a dramatic effect on SE Asia’s palm sector; for instance, in a southern region of Malaysia, whilst annual rainfall amount is more or less consistent, the pattern of rain is increasingly erratic with possible periods of 10 weeks+ with little rainfall.

Similar erratic rainfall has also been seen for instance in southern Philippines where many large pineapple / banana plantation operations have been impacted negatively.

If we look at parts of Thailand and Cambodia then their 4-5 months dry spell (December through April) can be incredibly dry with months of zero rain, but then this period is often followed by 7-8 months of intense rainfall which runs away as waste or causes floods

Can Technology help? The question each plantation owner is currently asking is “how can we make our plantation more climate resilient- where productivity is protected or even enhanced without incurring large upfront Capex investment or impact our margins through high Opex- can technology help here for us and our wider community of stakeholders and employees?”
Does ‘Sustainable Irrigation’ Exist? An irrigation system is of course invaluable to cover drought periods and optimise the production potential of each plantation - but what are the irrigation options for a 300 hectare plantation for instance?

Diesel pump to deliver 5200m³/day to 30m head Purchase price $45,000

Running Costs
Fuel / yr (9 lts/hr) $30,000
Depreciation Per year over 2.2 year life $20,000
4 x Servicing cost with pump running 8000 hrs/year $3000
Pump refuelling every 26 hrs $5000

Total operation cost per 300/ha $58,000

Diesel may have come down in price over past decade but still at $0.4 cents/ litre this is costly

Even if the diesel pump is operated for less time, high depreciation and servicing cost will remain.

How to break with fossil fuels? How can the African or SE Asian plantation sector possibly take on the extra burdens of diesel cost with approximately 100,000’s hectares of plantations need to be irrigated in just Malaysia alone; this would add $ millions in fuel, service and labour costs like this ‘ship engine’ being used as a pump here.

Value add from Irrigation? Even with such high fuel costs- the extra productivity looks worth it. For plantations of every size, a practical hedge against climate risk has frequently being reported by owners to be essentially “priceless”.

Coconut Plantation- a hard example;
- Situation without irrigation: 100 trees yielding 200 coconuts per year. That's 5 tons of copra per hectare, or $5,000/ha/yr
- Situation with irrigation: 300 trees yielding 260 coconuts per year. That's 19.5 tons of copra per hectare, or $19,500/ha/yr

Irrigation costs! Despite the tripling in productivity for this theoretical ‘coconut plantation’ example enabled by higher planting densities thanks to irrigation and higher productivity per tree; the extra cost of diesel powered system based on the costs above is conservatively $1million / annum over 10,000 hectares.
For Climate Change Ready Plantations - A Combination Counts; to fully maximise each plantations productivity potential – plantations can maximise their output using ground cover to stop evaporation, raise planting densities and use fast growing hybrids - and a few pioneers are already using all these methods to increase yields to support productivity and grow local employment.

Hybrid coconuts can be used to give much higher yield- though this is not possible with all plantations varieties. Cover crops can also be used to reduce evaporation plus a wide range of soil enhancement techniques, including beneficial microbes and biochar which all increase the soil’s ability to store water.

But it all comes down to irrigation! Yield per tree goes up 30% when enough water is provided during drought periods for hybrid coconut this is at least 200 litres per day.

Some pioneering plantations are now looking to utilise the surplus water flows from rivers by considering innovative new ‘zero fuel cost’ irrigation equipment which can pump long distances to storage when there are excess surface water flows allowing sustainable storage of water without incurring the cost of diesel!

Zero Energy Irrigation; systems which use the power of moving water to operate a pumping action are available but such ‘zero energy’ designs commonly used mostly date from Victorian Era technologies which are large, heavy and costly- despite being limited to only small scale pumping volumes which are going to be unable to deliver the volumes of water needed by plantation owners.
**What is the Action Plan?** With the right irrigation technology and right processes (hybridization etc) coconut plantations could even triple productivity which would have many local benefits; in the Philippines alone more than 3 million people depend on coconut farms for their livelihood. So the potential for poverty relief through this form of ‘farm upgrade’ across SE Asia could be significant- so what is the Action Plan to kick start this?

**Technology Trials;** Testing of new ‘zero energy’ water irrigation systems have already been taking place in African and ASEAN with surveys made to ensure the suitability. Feedback from such trials always concern overcoming the initial capex burden despite such rapid paybacks once installed.

Leading plantation developers and sustainability pioneers point to the $billions of sustainability / development finance available and the vital need for capex to upgrade plantations- while the attractive returns mean plantation owners should generate the cash flow needed to pay back the loans.

**SE Asia;** costing model is being developed with a leading sustainable coconut plantation developer with site survey completed in Philippines.

**Africa;** site survey and costing model developed with a palm plantation developer during 2014-15 in Ghana.

**Matching development capital with switched on plantation managers;** The demand is there, the results can be proven and now trials of innovative irrigation equipment have taken place across LATAM, Asia & African as well as UK- so now is the time for development capital to come forward and state the returns they need to support a sector so key for these regions to get ready for the 21st Century.
What is on offer for plantation owners? Productivity improvements are proven across every fruit cropping or plantation species but the aim would be to start with green field sites and existing plantations for coconut or palm which would be offered a ‘farm upgrade plan’; this would include planting higher densities of coconut and a sustainable irrigation system.

Make sure the community wins; higher productivity means more consistent employment, greater exports and higher value add content locally- but this has to go along side sustainable water use. In many cases pumping flood water should be welcomed in many SE Asian countries to reduce flooding.

Establishing new plantations with higher densities is seen as especially attractive as with a tripling of productivity, only 10,000 hectares would be needed vs 30,000 hectares before so reducing the amount of land utilised for plantations.

What is on offer for the investor? Once 10,000 hectares of fully irrigated hybrid coconut plantation is in operation this could generate as much as $195million in revenue (assuming $19500/ copra/ hectare) – paying back the initial investment of circa $50million, growing salaries for local employees and creating value add local supply chains. However, the risk around such substantial upfront capex needed is reduced by zero cost irrigation systems-therefore helping achieve maximum productivity for all stakeholders once each plantation is operational.
There is a small body of analysis of irrigation efficacy on coconut yields, but none on hybrids specifically.

Liyanage paper cites a Bhaskaran, Leela (1978) study that calculates a cost/benefit ratio of intra-seasonal irrigation of 1:3 but there are some questions about what this includes.

- [http://cri.nsf.ac.lk/bitstream/handle/1/4140/JNIPM-4%282%29-77.pdf?sequence=1&isAllowed=y](http://cri.nsf.ac.lk/bitstream/handle/1/4140/JNIPM-4%282%29-77.pdf?sequence=1&isAllowed=y)
- Studies focus mainly on covering the dry periods which are very pronounced (and feared) in India and Sri Lanka, but less so in wetter Philippines and Indonesia. Results indicate that covering dry periods with sufficient water may increase yields by as much as 50%. The issue appears to relate to the stunting of the immature coconut flowers during a dry spell, which leads to low yields even if sufficient water is available at a later stage of development.