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Infectious Diseases and Pandemic Threats in Africa: Analysis of Behavioural Change Theories and Multi-Dimensional Heterodox Responses for Sustainable Solution

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Abstract

This study was conducted to determine appropriate irrigation amount, fruit quality and water-yield relationship for date palm under dry conditions. The research work was carried out in Alkharj, Kingdom of Saudi Arabia, for two consecutive seasons (2016-2017) and (2017-2018). The treatment contained four irrigation water amounts, (ETC 100%, ETC 75% and ETC 50%) of date palm tree water requirement and the amount of water actually used (control). A mature date palm trees (Segae variety) of the same age (10 years) were selected randomly to perform the experiment in both seasons. The experiment was organized in Complete Block Design (CBD) and the analysis was done using SPSS. The measured parameters were water productivity (kg/m^3), yield parameter's (weight of date fruit /g and productivity kg/tree), and quality parameter's (moisture content (%), total soluble solid (TSS %), Brominated (%) of date fruit and Veneer (%)). Moreover, the quality of irrigation water used, was assessed and compared with FAO standard for irrigation water. The result showed that the water quality was found within the permissible level of FAO standard for irrigation water. The result also indicated that the amount of water using in the study area, is more than the actual amount of water needed by date palm tree (ETc100%) according to the local weather. Moreover, the water treatment (75% ETc) showed the highest significant differences (P≤ 0.05) of water productivity, moisture content, and (TSS%). While water treatment (100% ETc) revealed the highest values of productivity in both seasons followed by (75% ETc). Moreover, the Brominated and Veneer values were found within the recommended level according to the local standard. However, the water treatment (50% ETc) showed a high significant difference (P≤ 0.05) in compared with others treatments. This study concluded that date palm can growth perfectly with high yield and product quality with water regime ETc 75%. Therefore, huge amount of water can be saved when adopting this regime for date palm production.

Keywords: Deficit irrigation; Date palm; Water productivity; Date palm fruit quality

1. Introduction

The outbreak of infectious disease, particularly those for which little or no pre-existing immunity exists represent a significant risk to public health. Even when controlling confounding factors (such as improvements in surveillance, communication infrastructure etc), the number of infectious disease outbreak and fatalities has substantially increased since 1980. Few will suffice here. The discovery of Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012, 851 associated deaths was reported with cases across 27 countries. The H1N1 pandemic of 2009 was estimated a responsible for between 151,700 to 575,400 deaths worldwide during the first 12 months. The 2013-2016 Ebola outbreaks in West Africa led to over 28,600 cases with 11,325 deaths, while the outbreak in the

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Democratic Republic of Congo in Central Africa led to over 2200 deaths. The Corona Virus (COVID 19) as at January 2021 has led to 96,144,818 confirmed cases with a total death of 2,056,300 drawn across 191 countries. These presents a stark reminder of the public health threat to Africa in Africa in particular and the globe at large.

Given the trends, it is therefore critical to ensure that emergency preparedness, response and resilience is optimized to mitigate the occurrence and/or impact of these events. This study seeks to identify the inherent gaps in containing them, as well as proffering sustainable solutions towards arresting them. The behavioural science and multi-dimensional heterodox responses represents such broad of mitigation windows in arresting these scourge.

The Behaviour Change Theories and Infectious Diseases.

The importance of encouraging adaptive and protective behaviour change in response to public health emergencies is emphasized by the World Health Organization (WHO) that provide risk communications guidelines designed to encourage individuals, families, and communities to act to protect themselves. This is echoed in the context of COVID-19, with Michie et al (2020) stating that "human behaviour will determine how quickly covid-19 spreads and the mortality. Therefore behavioural science must be at the heart of the public health response.

Research in the behavioural sciences has focused on identifying barriers and facilitators to maximizing public compliance with recommended emergency response and infection prevention behaviours. For example, decontamination behaviour such as: medication adherence, hand washing, social distancing/avoidance behavior, and vaccination, to name but a few. Furthermore, in the context of infectious disease emergencies, mathematical models are used to both: a) understand and map out the spread and control of disease (incorporating human-to-human transmission) and, b) calculate the potential effectiveness of interventions (including behavioural interventions) to reduce the spread of the disease. Considered together, the importance of human behaviour for emergency response – both in terms of developing interventions and its relevance for modeling the potential efficacy of said interventions – is clear. The major limiting factor of the traditional mathematical models is that they do not allow for heterogeneous behavioural responses within the population. The assumption that human behaviour is homogenous can impact on the validity of these models. For instance, including a modest degree of fear-related flight behaviour (i.e., 10% of individuals in a model respond to fear of infection with flight) into a model in which fear of infection otherwise leads to hiding, caused projected disease incidence to rise to ~ 65%, up from ~ 30% in a model in which fear of infection led all individuals to hide. Although some recent infectious disease models do incorporate social and cognitive predictors of the kinds of self-protective health behaviours that are associated with infectious disease control and emergency response (e.g., vaccination uptake, social distancing etc.), they are more commonly informed by literature from behavioural economics than psychology.

According to Michie and colleagues, there are a total of 83 behaviour change theories across the behavioural and social sciences. Over the past three decades, multiple review papers and books have attempted to identify trends in theory use including those most frequently applied. Despite some commonalities in underlying psychological processes (Michie and colleagues cede that many of the 1659 constructs identified within their book were different labels for overlapping constructs, this proliferation of competing theories and recommendations could indeed make it difficult for researchers, intervention designers, and modelers to decide which theories to use and in what context. However, there are still a large number of behaviour change theories that were designed with specific applications in mind: for example, the Behavioural-Ecological Model of Adolescent AIDS Prevention, the Integrated Theory of Drinking Behaviour , or the Social Ecological Model of Walking. Public health researchers, infectious disease modelers, and practitioners may therefore be understandably perplexed as to how best to model and examine or influence behaviour in the specific context of infectious disease outbreaks or emergency response.

2. Heterodox Responses Debate, Infectious Diseases and Pandemic

The main thrust of the heterodox responses debate is that in an era of infectious diseases and pandemic threat, Africa's sustainable future is guaranteed than the current lockdown approach we are witnessing.

The current lockdown suffers time-inconsistency problem without credible exit strategy. It is neither affordable nor sustainable in Africa and has the potentials to worsen the twin pandemics-health and economics. Hence the glaring need for continent to the "reset button now by mainstreaming its collective through simple, smart learning-by-doing solution that could, in the end build adequate capacity for significant exports from Africa to the rest of the world. This approach is further given impetus due to the fact that the current COVID-19 will not be the end of techno-economic disruptions or even health pandemic in decades. Therefore, this is an opportunity for Africa to think without the box to engender greater self confidence in our capacity to think through our problems, with authentic sustainable solutions" (Soludo 2020)

Furthermore, the idea of lockdown and border closure means we will continue to do so (with extensions) until such a time we are satisfied that the spread of infectious diseases and pandemic has been arrested or on decline (with the possibility of imposing another round of lockdown, if new infections surge). If the strategy is to lockdown until an infection stops or significantly decline, then we would playing a suicidal indefinite waiting game'. These are also not sustainable as the heterodox (creative local) approach without lockdown is the preferred choice and on net basis are achievable in the short and medium term basis, consistent with our social and economic realities.

There are ten key reasons why the heterodox approach is the preferred choice as against for Africa. They are summarized thus: Monitoring requires effective testing and Africa cannot afford effective testing of her 1.3 billion people; Stigma associated with infection, on the average Africans only go to the hospital as the last resort and in asymptomatic cases only critical ones will report. So there will always be under testing and gross under reporting; Impracticability of social distancing in most part of Africa especially in shanty areas where social clustering, not distancing is affordable and a survivalist culture; Most African states cannot pay for lockdown as their budget are still aid dependent with support from bilateral and multilateral donors coupled with balance of payment problems, and because they cannot pay, over 1 billion people are left to survive if they can or perish if they must; The lack of credible demographic data to identify and target the most vulnerable as in developed climes where we copied the lockdown/ border closure, their citizens are literally paid to stay at home; Social consequences such as unemployment especially among the youth, endemic poverty as well as the dependency burden is still very high in Africa; Economic consequences as African countries are facing worst economic conditions in decades with commodity prices falling drastically, with oil producers in precarious state, further buttressing the argument that Africa should creatively craft a plan to transition to the world with little or no oil; Dearth of infrastructure (basic electricity is deficient) and that makes the compulsion to stay at home hellish for most people; Extortionist tendencies of security agencies as 80% of the African population live from hand to mouth on daily toil and the lockdown creates opportunities for extortion by security agencies as those who pay, move about; and Africa's financial and structural weakness makes her not to have the luxury of using the same 'conventional tools' of western countries in the face of the twin pandemic. At a minimum Africa needs her most important asset (full population) working at full throttle to have any chance of defeating the impending economic catastrophe.

In summary the heterodox approach entails that we should: Think African and act locally and opportunistically to survive and prosper; Apply a multidimensional approach to solution of infectious and pandemic diseases far beyond economic and western *ad hoc* responses that are not sustainable; Anticipate and plan for disruptions so as to exploit the opportunities therefrom; Develop new ways of socialization; Craft simple, smart and sustainable responses using useful data and lessons learnt during the pandemic. Heterodox approach also means that governments should lead the people to mainstream the African spirit of community/collective action by mobilizing churches, mosques, Civil Society Organizations (CSOs) in public education and mobilization; Prioritize health care delivery so as to contain future health pandemic; All critical stakeholders should be mobilized to agree on simple, smart solutions consistent with financial and social realities; Embrace the model of learning-by-doing while mainstreaming basic commonsense tips such as wearing of masks in public, and basic hygiene; Apply positive multiplier effect for job creation in the African economy in the production of face masks, sanitizers, gloves etc; Test some local herbs for the cure of these diseases and pandemic; and Apply a comprehensive strategy for diversification and global competitiveness.

3. Situating the Heterodox Approach within the confines of the Green and Blue Economic and Sustainable Development Debate.

Situating the Heterodox approach within the green and blue economic and sustainable development framework will be interesting for several reasons. They are: First, it will usher in the era of 'Disruptive innovation as against the current 'business as usual' (BAU) model Incremental innovation. Disruptive innovation, apologies to Tait J, Banda G, and Watkins A (2017) involves discontinuities in innovation pathways, requires new research and development, creation of new modes of production and new markets. It can lead to sectorial transformations, the displacement of incumbent companies, and creation of entirely new sectors with significant societal and economic benefits. There may be no obvious regulatory precedent to govern potential human and environmental safety issues; in some cases it may lead to citizen and stakeholder concerns from an early stage of development. For a disruptive innovation, there may be no existing business model on which a company can build, and there may also be a need to create a new value chain, or to create a new role in an existing value chain. These are part of the indices in a green and blue economic and sustainable development framework.

Second, the approach is also interesting in the sense it holds much promise for Africa when properly situated within the confines of green and blue economic and sustainable development paradigm. This is so because, for instance, in a post COVID 19 pandemic era, the approach envisions for Africa a system that ensures an overhaul which requires great human creativity and innovation (smartness), tremendous knowledge and widespread participation in Africa's socio- economic and ecological transformation.

Third, the approach is also critical in the sense that the acknowledged the failure of the market system and the world is now on the verge of depression. The pandemic has cut everybody pant down with no known cure. The United States of the America which is the biggest economy in the world is in 'trial and error' basis. For decades now, it has been the position of green economic thinkers that the market (conventional) economics has provided no analytical framework to counter or even address Africa's numerous development and ecological challenges such as climate change, deforestation, ocean surge, diseases, erosion, desertification, depletion of biodiversity, as well as ending her age-long poverty scourge. The individualistic frontier tendency of the market system has no connection with the natural systems, between the present, the future and the people. That the individualistic consumers' trade on private goods is further compounded by the promotion of optimal growth theories that entail exponential population growth and resource use - a frontier society without limits. A green and blue economic debate does not prioritize support for either the 'public' or the 'private' sector. Rather it argues that both sectors must be transformed so that markets express social and ecological values and the state becomes merged with grass root networks of community innovation. For this to happen, new economic processes must be designed and new rules of the game written, so that incentives for ecological conduct are built on everyday life. In this case, the state with 'political statesmen, (apologies to Soludo), can function more as coordinators. This system is different from the current profit and power-driven market forces. Heterodox idea fits into the green and blue economic and sustainable development thinking.

Fourth, the heterodox thesis, like green and blue economic and sustainable development debate, will seek to address Africa's development challenges especially the glaring need to reconfigure the structures of production, distribution and consumption of goods and services in a way that can build a new and solid foundation for future growth and sustainable development. These include: ending current high mass consumption and overshoot of the planet's resources and returning to live within the comfortable bounds of nature in the climatic conditions under which humans built their civilization; choosing lifestyle changes over techno fixes and eco-technology; moving towards a low carbon production techniques, that is, lowering our carbon usage and living lightly on the earth; choosing how economics is done, from being an abstract mathematical exercise to embracing realism and the real world we live in and share and in which we are all concerned stakeholders.

Fifth, the heterodox thesis, as part of the substructure of green and blue economic and sustainable development framework, will seek to address social goals such the creation of smart businesses and job opportunities as well as reconciling social goals with other objectives of economic policy such as agriculture and food security policy. The central role of women and youth in the economy will be finally recognized and reflected in the policies and measures that buttress heterodox responses.

Sixth, heterodox thesis within the framework of green and blue economic and sustainable development debate will seek to align macroeconomic policy frameworks and development strategy with dynamic pathways of sustainable development so as to create a win-win synergy. Such policy frameworks would include but not limited to environmental fiscal policy, agricultural policy, private/public sector policy, financial planning and so on. These green related policies if implemented to the letter by government will ensure Africa's sustainable transition to a low carbon and resources efficient economy.

4. Recommendation and Sustainable Solutions

As earlier highlighted, infectious diseases and pandemic especially recent one, corona virus, COVID 19 pandemic ravaging the whole world comes with further disruptions and threats: stigma of isolation, social distancing, lockdown and so on. These represent the new normal and they will not be the end of techno-economic disruptions and health pandemic in the coming decades.

Therefore, Africa should harness the importance of human behaviour for emergency response as earlier highlighted in this work– both in terms of developing interventions and its relevance for modeling the potential efficacy of said interventions.

Also the continent can get used to this and plan for the disruptions using the heterodox response approach mainstreamed into the green and blue economic and sustainable development thinking. This is to enable the continent to opportunistically exploit them and at the same time avoiding blame shocks. These entails crafting of simple, smart, multidimensional sustainable responses that includes new ways of socialization; intensive advocacy, sensitization and mobilization in all levels of government to the effect that infectious diseases and pandemic threats are not death sentences as you can be doing your work/businesses in a smart way; priority in the provision of public health care; expanding the scope of curriculum on health sciences to include African natural herbs, nutrition, basic epidemiology of infectious and non-infectious diseases, heath policy, health system design, analysis and management; mainstreaming common tips in our national life such as wearing masks, disinfecting all open markets every early morning and all places of public gathering; all transport systems and all passengers wearing masks with hand sanitizers etc. The positive multiplier effect of the aforementioned sustainable solutions in terms of healthy and livelihood building, job creation, and economic growth of the continent will be enormous.

5. Conclusion

Human behavior for emergency responses and heterodox approach in a post COVID 19 era and the techno-economic disruptions and health pandemic, no doubt, hold much promise and opportunities for Africa if properly situated within the confines of the green and blue economic and sustainable development pathway.

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