Linkage between sustainable agricultural technologies and the bioeconomy

John Manners
Director, CSIRO Agriculture and Food, Canberra, Australia [Email: john.manners@csiro.au]

ABSTRACT:

It is well recognized that there is a need to sustainably increase food production to meet rising global population growth in the coming decades. It is most likely that this challenge will be met through a systems approach where multiple interventionsare applied in combination to increase productionas well as reducelosses and waste. In the futurebioeconomy, farming land will be subject to competition for food, fibre, bioenergy and biomaterial production as well as carbon sequestration as climate change mitigation financial incentives increase for agriculture. Recent bio-economic modelling of future land use in Australia under diverse potential carbon price scenarios has indicated that even moderate carbon farming incentives would cause significant changes in agricultural land use. In general, it has been considered that farming for carbon sequestration and other environmental benefits wouldinevitably result in a trade off in reduced economic growth. However, the good news from these models is that this is not the case and that farm profitability and productivity are predicted to rise across all scenarios.Such a positive growth outlook for agricultureis consistent with a prevailing bullish investment attitude towards future agribusinessand this is leading to new interest from sectors not traditionally associated with agriculture including, for example, digital service industries. Digital technologies combined with advances in remote and proximal sensing are allowing farmers to close yield gaps by more precise spatially and temporally targeted management practices. New management tools such as virtual fencing for livestock are examples of modern farming innovations that have come from digital technologies. Water will be an ever increasingly precious resource for future productivity increases and tailored watering according to a plant's individual physiological need is now possible using sensor technologies. In addition, new physicochemical tools such as biodegradable, sprayable polymers have been developed to help maximize available water use in plant production. Similarly, our understanding of the relative value of multiple plant traits that can underpin a specific crop's water use efficiency has improved by combined applications of genomics and phenomics. One rapidly growing food production system that relies less onfreshwater is aquaculture and recently global farmed seafood protein productionexceeded both that from wild catch in the oceans and also terrestrial beef production. Aquaculture as a relatively recent industrial scale production system is open for technological disruption and examples of this are, rapid yield gains through breeding, bioactives that stimulate growth and terrestrial-based feeds that contain essential nutritional components such as omega-3 oils currently only obtained from dwindling fish-based feedstocks. Technological disruptions from new genetics also promise to massively alter crop production potential, these include game-changing technologies such as the production of high yields of vegetable oils from biomass, broad spectrum durable disease resistance and nitrogen fixation in non-leguminous plants. All of these game-changing technologies rely on genetic modification. The challenges of meeting global food production goals is very pressing, especially when we consider that the development, delivery and adoption of new technologies in agriculture often takes a decade. This means that the technologies that will underpin a sustainable bioeconomy have to be discovered, developed and accepted in the next decade if they are to be effectively adopted for the critical decades of 2030-2050 when population and resource pressure will beat its most intense.