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OUTLOOKS ON PEST MANAGEMENT

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COVER PHOTOS: Cotton bollworm (*Helicoverpa zea*) (Photo by Scott Bauer) and *Aedes* (*Ochlerotatus*) sp. mosquito on human skin both reproduced courtesy of USDA-ARS; Cocoa showing both frosty pod rot (*Moniliophthora roreri*) and witches' broom (*M. perniciosa*) on the same branch (Ecuador) (Photo by Roy Batemen); Unsprayed strip in sugarbeet showing poppies (*Papaver* spp.) (Photo by Alan Dewar)

COP26: WHAT DOES IT MEAN FOR THE AGRICULTURE SECTOR?

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Climate change challenges and the urgent need to take things seriously were once again thrust into the spotlight in October and November 2021 with the 26th United Nations Climate Change Conference (COP26) held in Glasgow under the presidency of the United Kingdom, in partnership with Italy. COP stands for Conference of the Parties, and the summit was attended by the countries that signed the United Nations Framework Convention on Climate Change (UNFCCC) – a treaty agreed in 1994. Billed by many as the most significant climate event since the 2015 Paris Agreement, COP26 aimed to accelerate action towards the goals of both the UNFCCC treaty and Paris Agreement, such as for every country to work together to limit global warming to 1.5°C. Nationally Determined Contributions (NDCs) were central to the Paris Agreement and outlined efforts from each country to reduce national emissions and adapt to the impacts of climate change. Unfortunately, the commitments laid out in Paris in 2015 did not come close to achieving the 1.5°C target, and with the window for action becoming ever smaller, there was substantial pressure on Glasgow to deliver something meaningful. Following two weeks of intense negotiations, COP26 finally ended with nearly 200 countries agreeing the Glasgow Climate Pact. Crucially this pact keeps the 1.5°C reduction alive and completes the Paris Rulebook, a set of guidelines for how the Paris Agreement will be delivered including a transparency process to hold countries accountable as they deliver on their targets.

But what about agriculture? Despite being the second largest driver of climate change behind the energy sector, and therefore central to meeting emissions reductions and achieving the 1.5°C target, the general consensus was that the agriculture sector did not feature prominently enough at COP26, and that reliance on major pledges and pacts disguised a lack of detail on exactly how action would be achieved. Under the UNFCCC there is only one program focussed on agriculture – the Koronivia Joint Work on Agriculture (KJWA) which was established at COP23 in 2017 and aims to address agricultural issues through the lens of climate change. It is composed of six interrelated topics, namely soils, nutrient use, water, livestock, methods for assessing adaptation, and the socio-economic and food security dimensions of climate change across the agricultural sectors (FAO, 2022). The process was scheduled to finish at COP26; however, by the end of the meeting there were still many areas of disagreement and so these will need to be ironed out in the future. Furthermore, despite pledging action, none of the updated NDCs submitted by the G20 nations prior to COP26 included specific targets on how commitments made for their agricultural sectors would actually be achieved in practice. Many of the current challenges in

agriculture are political in nature, whether it is the desire of developed countries to reduce meat and dairy consumption and move towards more plant-based diets, or the reluctance of developing countries to agree, or discussions on farm subsidies, so it is perhaps not surprising that these challenges were not tackled.

Agriculture plays a key role on both sides of the climate change debate as both a source and sink for emissions. Approximately 20% of global anthropogenic greenhouse gas (GHG) emissions including carbon dioxide, methane and nitrous oxide come from agriculture, forestry and land use (Ritchie & Roser, 2020). This value increases to 31% when considered across the whole agrifood system that includes crops and livestock (FAO, 2021). When split individually, agrifood systems globally account for 21% of carbon dioxide emissions, 53% of methane emissions and 78% of nitrous oxide emissions (FAO, 2021). Whilst the principal GHG emitted by most sectors is carbon dioxide, the agricultural sector is unusual in that direct emissions of methane and nitrous oxide, in particular, are far higher. Given the importance of these GHGs both as key drivers of climate change, and to the agricultural sector, it is timely to review COP26 discussions in this area.

Some progress was made on methane emissions through the Global Methane Pledge, which was spearheaded by the US and EU, and saw more than 100 countries committing to reducing their overall emissions by 30% by 2030, compared with 2020 levels. The primary source of methane in agriculture is through gastroenteric fermentation in ruminants, and to a lesser extent, from manure, and microbes in paddy rice fields. Although methane has a higher global warming potential (GWP) of approximately 30 times that of carbon dioxide, it only has a half-life of approximately 10–12 years, much shorter than carbon dioxide which can remain in the atmosphere for over one thousand years (US EPA, 2022). For this reason, the UN considers that cutting “methane emissions is one of the most cost-effective strategies to rapidly reduce the rate of warming and contribute significantly to global efforts to limit temperature rise to 1.5°C” (UNEP, 2021), and so it was no surprise that this was targeted at COP26. Despite European Commission President Ursula von der Leyen’s assertion that “it is the lowest hanging fruit”, many critics considered that the non-binding pledge did not go far enough. For example, whilst there was a focus on technological solutions to drive efficiency improvements such as the use of animal feed additives to reduce methane, more challenging behavioural changes such as reducing meat consumption, encouraging a shift towards more plant-based diets, and reducing waste, were left off the table, and the world’s three largest methane emitters – China, Russia, and India – did not sign up.

If some progress was made on methane, then the opposite was true for nitrogen and nitrous oxide emissions which, in agriculture, are largely due to the use of synthetic nitrogen

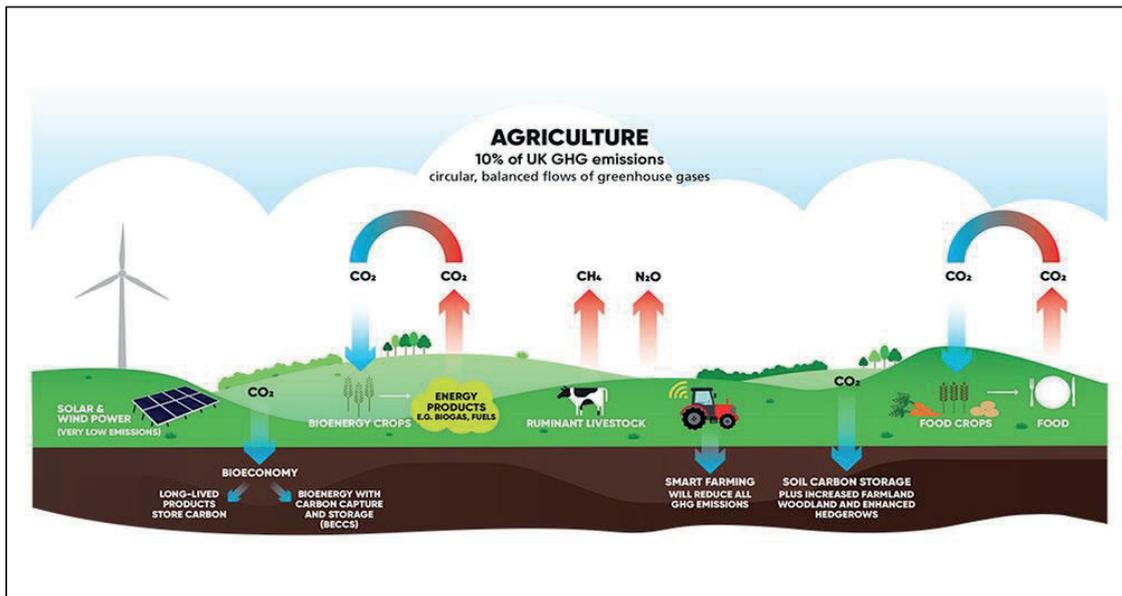


Figure 1. Achieving net zero by 2040 (source: NFU).

fertilisers, and animal and plant waste. Nitrous oxide has a GWP nearly 300 times that of carbon dioxide and stays in the atmosphere for over 100 years (US EPA, 2022), making it significantly more potent than both carbon dioxide and methane. Without action on nitrogen, scientists warn that achieving the global ambition of net zero by 2050 will be impossible. The #Nitrogen4NetZero initiative was launched in April 2021 to raise awareness of the need for sustainable nitrogen management and proposes halving nitrogen waste by 2030 and is led by the UK Centre for Ecology & Hydrology (UKCEH) as part of the International Nitrogen Management System (INMS) and hosted on behalf of the United Nations Environment Programme (UNEP) (INMS, 2022). Agricultural goals include helping avoid excess crop fertilisation under climate change, which would otherwise exacerbate GHG emissions, promoting sustainable nitrogen management for bioenergy crops, and reducing nitrogen pollution which threatens biodiversity. The initiative had already gained support from several countries in south Asia, led by Sri Lanka, and there was hope more might sign up at COP26; however, talks on cutting nitrogen pollution were largely side-lined by the UK presidency, preferring to focus on other issues instead.

Direct emissions of carbon dioxide from agriculture are much lower than methane and nitrous oxide, and are driven by energy use from agricultural production (e.g. tractor fuel), and in the manufacture of inputs such as fertilisers and pesticides. However, indirect emissions from deforestation and land-use change, particularly in developing countries as land is cleared to make way for crops, are also important. Efforts to reduce the impact of land-use changes on carbon dioxide emissions were boosted with a pledge from more than 100 countries to halt and reverse deforestation by 2030. Approximately 90% of the world's forests are covered and key emitters of GHGs from deforestation, such as Brazil, China and Indonesia, have signed up which is encouraging. Environmental groups have pointed out the failure of previous commitments such as the 2014 New York Declaration which also sought to halt deforestation by 2030, failing to meet its interim target of

a 50% reduction by 2020, and actually increasing deforestation. However, the inclusion of financial commitments in the COP26 deforestation pledge, such as the intention to provide \$12bn for forest-related climate finance between 2021 and 2025 that includes willing participation of Indigenous Peoples and local communities in programmes that protect and restore forests, reduce deforestation and forest degradation, may improve the chances of success. Other financial initiatives include the UNFCCC backed Race to Zero and Race to Resilience campaigns which have united asset managers responsible for more than \$8.7tn from 33 major financial institutions, to commit to stop financing deforestation through investment in agricultural commodities such as palm oil, beef and soybeans. Other announcements with a direct impact on agriculture included a 45-nation Policy Action Agenda to deliver a food system that is not only low-carbon and deforestation-free, but also supports farmers, reduces water and chemical consumption, and produces less waste. A Global Action Agenda involving the same 45 nations and 100 businesses and farmer groups aims to leverage more than \$4bn of public investment in innovations such as climate-resilient crops, digital technology and solutions to improve soil quality.

The benefits of agriculture in the climate change debate are often overlooked. Agriculture is the only sector with the natural ability to sequester and store carbon, and as such it can be considered part of the solution, not just part of the problem. According to the FAO (2022), the volume of carbon sequestered from the atmosphere by agriculture effectively offsets at least 20% of the sector's carbon dioxide emissions. There are many initiatives being undertaken to increase carbon removal by agriculture. For example, in the UK, the National Farmers Union has announced a strategy to achieve net zero by 2040 in England and Wales by using agriculture and the land-based economy to capture carbon dioxide from the atmosphere and, with the help of farmers, turn it into a wide range of foods, fibres and fuels (NFU, 2019) (Figure 1). The ideas are split into three pillars: (1) Productivity, e.g. the reduction of production emissions as far as reasonably practicable including improved

nutrient efficiency, and precision fertiliser and slurry application; (2) Nature-based carbon storage such as adding organic matter to arable soils, maintaining permanent grassland, planting and managing trees or woodland, and restoration of peatlands and wetlands; and (3) Renewables and the bioeconomy to offset residual emissions including the use of solar PV, biomass heating, and supply of bioenergy feedstocks. The NFU are also working with technology providers on carbon calculators to allow farmers to calculate their carbon footprint and then take steps to reduce it. Reducing emissions of methane and nitrous oxide is more difficult than cutting carbon dioxide, partly because they result from natural processes that are not as well understood, hence the ambition of the NFU to achieve “GHG balance”, i.e. enhance the ability of agriculture to capture carbon to generate “negative emissions” where active removal of carbon dioxide is balanced with agriculture’s emissions of methane and nitrous oxide.

Although carbon capture solutions are welcome in the drive to help reduce emissions, they can also be subject to abuse. For example, there have been recent stories of Welsh farmers receiving unsolicited requests from people interested in buying their farms in order to plant trees and offset their carbon footprint. This needs to be managed appropriately to ensure that sufficient land remains for food production and biodiversity, but also that companies do not use these carbon offsetting initiatives in order to avoid cutting emissions at source, and therefore not actually reducing atmospheric carbon dioxide concentrations at all.

One of the often overlooked challenges with trying to gain global climate change action and agreement is that it does not take into account the maturity of markets, trade and economies. This is especially true in the agricultural sector, where developing countries that are finally thriving economically as a result of continuing intensification of their farming systems, are wary of efforts by more affluent Western countries to reduce their inputs and emissions when those Western economies have already prospered from the same. Although the use of renewable energy sources in agriculture is increasing, the sector continues to be dependent on fossil fuels for agricultural production (e.g. for tractor fuel), the manufacture of inputs such as fertilisers and pesticides, and post-harvest processes such as storage and refrigeration. For the first time at COP26, there was agreed action on phasing down coal, which represented a watering down of initial efforts to commit to phasing out coal by developed countries where production had already peaked, largely due to last minute amendments by India, China and other coal-dependent developing nations. Although coal is the most polluting of the fossil fuels it was interesting that progress to phase out oil and gas, which are still considered the dominant fuel sources in many developed and developing countries, was limited to just seven countries and with the world’s largest consumer, the USA, absent.

In a previous editorial, Copping (2021), suggested that as COP26 was the 26th meeting, did that mean that there 25 earlier failed attempts at controlling emissions? It is certainly true that action on climate change previously did not get the attention it deserves, but having realised that action desperately needs to be taken, progress is now too little and seemingly too late. Perhaps it is time to rethink the concept of green growth, championed by the OECD and countries such as the USA, where continued economic growth and development is fostered while associated negative environmental impacts, including climate change, are reduced. Green growth relies on technological change and substitution to allow GDP growth to be decoupled from resource use and carbon emissions (OECD, 2022); however, continuing on this path looks increasingly unlikely to meet the 1.5°C target. The onus now moves to COP27 in Sharm El-Sheikh, Egypt, later this year, and we can likely conclude on 26 earlier failed attempts and counting.

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