An examination of post-pandemic crop management innovations for climate change resilience

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ABSTRACT

Global warming, a notable rise in average temperature brought on by human-induced emissions of greenhouse gases (GHGs) and agricultural practices, has been exacerbated by increasingly intensive agriculture, deforestation, and the use of fossil fuels. Extreme weather events, droughts, fires, the extinction of plant and animal species, disruptions in the food chain, and the depletion of agricultural resources are just a few of the detrimental effects of climate change brought on by this sometimes dangerous human intervention with the environment. In order to lessen the detrimental effects of climate change on agriculture in the post-pandemic period, it is necessary to use ecologically sound crop management techniques. Climate smart agriculture (CSA) and climate resilient sustainable agriculture (CRSA) must be used to maintain food security driven by crop management technologies. By using additional technology advancements via scientific study, farmers must create crop management technologies that will address the detrimental effects of climate change on people, animals, and the environment. To strengthen herd immunity and stop the COVID-19 virus from spreading across the population, access to high-quality and reasonably priced food items is crucial. Only by making sure that agricultural output is appropriately adapted to the effects of the current and impending climate change scenarios in the post-pandemic age will this be possible.

Keywords: Crop management innovations, climate change, post-pandemic era, COVID-19, food security.

INTRODUCTION

Global warming brought on by greenhouse gas emissions from human activity and agricultural practices that cause significant changes in weather patterns are both included in climate change. Because agricultural systems are climate-dependent, climate change directly affects agricultural output. This effect is particularly significant in developing nations where the majority of people rely on agriculture for both work and financial gain (Enete and Onyekuru, 2011). In Nigeria, food availability is unstable. Due to the COVID-19 pandemic, droughts and floods brought on by climate change, and general instability, Nigeria's low agricultural production in 2020 is blamed for the country's high food prices. The capacity of farmers to produce the food crops that the public most wants is impacted by the consequences of global climate change. Crop production is increasingly being impacted by unpredictable weather and more severe occurrences, such as droughts and floods, shifting growing seasons, scarce water supplies, and proliferating weeds, pests, and fungus. Furthermore, decreasing biodiversity has an impact on crop pollination, and soil erosion is lowering the amount of land accessible for agriculture. Farmers are also under pressure to reduce their usage of agricultural inputs and save water (https://www.syngenta.com/en/innovation-agriculture/challenges-modern-agriculture).

Food security in developing nations, especially in Nigeria, is being impacted by climate change. The majority of poorer countries were already suffering from low food intake, which led to malnutrition owing to food insecurity brought on by climate change, when the COVID-19 pandemic began to wreak havoc on many countries (Awopegba and Adeboye, 2021). The agricultural industry has been impacted by climate change and its consequences, such as unpredictable and unstable rainfall patterns, endangering community revenue and driving many to relocate in pursuit of better possibilities or supplementary financial benefit. Additionally, health-related stresses like COVID-19 have a significant influence on the agriculture sector by exposing the food and distribution systems' weaknesses via supply chain instability and interruption of international commerce (Adeboye et al. 2021; IOM, 2020). In Nigeria and other parts of the globe, agricultural productivity is being negatively impacted by climate change. A protracted impact of climate change on agriculture led to a lack of rainfall in Nigeria, which began in early July and lasted until the end of August in 2020. This resulted in a nearly two-month dry spell in the South-West and North-Central zones, which had an impact on food production during the COVID-19 pandemic. It is crucial to adopt the crop management innovation of switching from rain-fed agriculture as the first step in investigating irrigation technology in Nigeria by making efficient use of the many dams that are now available.

Ecological Agriculture (AE), Climate Resilient Sustainable Agriculture (CRSA), Agroforestation, and Climate Smart Agriculture (CSA) are examples of agricultural technologies that have been shown to be

successful in reducing the detrimental effects of climate change on food production (FAO, 2015). To withstand the challenges of climate change, agriculture also needs more cutting-edge technologies like agricultural drones, satellite imagery, phase tracking, weather forecasting, automated irrigation, light and heat control, merging datasets, farming software and online data, intelligent software analysis for pest and disease prediction, soil management, and other complex analytical tasks. The advancement of crop management technologies for climate change adaptation and mitigation for sustainable crop production in the post-pandemic period is examined in this study.

1.0 INNOVATIONS FOR SUSTAINABLE FOOD SYSTEMS

Globally, and particularly in sub-Saharan Africa (SSA), food systems are under stress. Food and nutritional instability has significantly increased due to COVID-19 and climate change (Adeboye et al., 2021), impacting vulnerable families in almost all developing nations (Awopegba and Adeboye, 2021). Nigeria's agricultural industry has several challenges that have a detrimental impact on production, despite the industry's significance to the country's economy. Among these include soil degradation, low irrigated farming, inadequate land tenure, and climate change. Other factors include low technology, high production costs, insufficient market access, huge post-harvest losses, and inefficient input distribution. Nigeria's 70.8 million hectares of agricultural land are mostly used to cultivate rice, millet, yam beans, cassava, guinea corn, and maize. Nigeria produced 4.0 million metric tons of rice in 2018 compared to 3.7 million metric tons in 2017. Nigeria produces 57% of the 6.7 million metric tons of rice used annually; the remaining 3 million metric tons are either imported or smuggled into the country illegally. In 2019, the government banned imports of rice in an effort to increase native output. Furthermore, animal output has continued to be underused. Nigerian agricultural households often grow small ruminants like goats (76 million), sheep (43.4 million), and cattle (18.4 million). Local demand exceeds supply here as well, despite many efforts by development partners to increase output and guard against illnesses like transboundary animal diseases. The significance of forestry to agriculture and overall development cannot be overstated. Nigeria's forest ecosystems are under danger from economic activity and fast population growth, with annual deforestation rates ranging from 0.72 to 2.38 percent, according to the FAO's 2018 report. This tendency is influenced by a number of factors, including increased agricultural production, a heavy dependence on firewood and charcoal for energy, unsustainable timber extraction, urbanization, grazing, bushfires, and infrastructural development.

1. In comparison to September 2020, food costs in Nigeria have significantly risen from September 2021. Oil, corn, and beans had the biggest price increases. Specifically, the cost of beans rose by about 60% compared to the prior year, but the cost of palm oil rose by 40%. None of the chosen foods had their prices lowered. Nigeria really has one of the highest Current trends indicate that the 2030 goal of ending hunger will not be achieved due to persistent inequality (FAO, 2017).

   Innovative methods and techniques must be created and used globally in order to make our food systems more sustainable. These technologies must generate revenue and employment in order to be economically viable. They must lower rates of hunger and malnutrition and engage vulnerable and impoverished populations in order to be socially viable. They must assist us in protecting the quality of our water, land, and air while reducing greenhouse gas emissions, food loss, and waste in order to be ecologically sustainable (https://farmingfirst.org/food-systems#section_4). Two of the most well-known environmentally acceptable methods for recycling manures under aerobic conditions are composting and vermicomposting rabbit feces (in pellet form), cow dung, poultry droppings, and other animal manures. These processes convert the manures into safer and more stable products (compost and vermicompost), which have advantages for both agriculture and the environment. Particularly, vermicompost and rabbit dung compost are reportedly inexpensive to make and may be used as organic fertilizer to boost crop yield and quality. It has been shown that rabbit dung has high levels of phosphorus and potassium (Dixie, 2016), nitrogen (Dianita et al., 2022), and other minerals that are enough to make up for the soil's deficiencies. Furthermore, it has been shown that rabbit pellets contain high concentrations of advantageous micro-elements and do not endanger plants when applied. Despite claims that vermicompost is healthier than any other kind of organic fertilizer (Abdulraheem and Onifade, 2021), Nigerian farmers have not adopted vermicompost or organic manure compost.All kinds of food security are anticipated to be impacted by changes in new technological processes in the food and economic systems. Innovative crop management techniques are often successful if they provide decision support systems, which make agricultural science more approachable, flexible, and practical for farmers. According to Nciizah and Wakindiki (2015), using creative strategies to combat climate change has resulted in three successes: an increase in agricultural output and incomes, crop resistance to climate change, and a decrease or removal of greenhouse gas emissions. Nigeria is expected to have 400 million people by 2050, therefore using modern technologies will boost agricultural output.

   and innovations would be needed to ensure nutrition and food security. To achieve this goal, all partners must support the work of the federal and state governments.

1.0 CLIMATE CHANGE AND FOOD INSECURITY

2.0 One of the industries most vulnerable to the effects of climate change, including floods, droughts, river erosion, and cyclones, is agriculture (Sarkar, 2012). By raising temperatures, changing the availability of water, and causing severe weather events including floods, droughts, storms, cyclones, and landslides, climate change has an impact on agricultural output (Zamasiya et al., 2017). Food hunger and climate change shouldn't be addressed as distinct problems. According to Fayose et al. (2022), climate has a significant impact on both biotic and other abiotic elements of the environment; its influence cannot be overstated because it affects the kinds of plants, animals, and microorganisms that grow in a given area as well as the processes that lead to soil formation. Ecosystems, which are the cornerstones of global agricultural output, are changing more and more due to climate change. Food security and the utilization of agricultural inputs have become unclear as a result. Regular soil dryness in certain areas, floods following heavy rains, inadequate farm-to-market roads, the usage of crude agricultural instruments, and the high cost of fertilizers are some of the main obstacles to agricultural growth, according to ATPS (2013). Water shortage is a significant issue that affects all forms of agricultural output in Nigeria. The primary cause of this water scarcity is climate change. Increased urbanization and soil degradation have been made worse by climate change, which has led to a growing water shortage in plants. Farmers always search for new methods to survive by embracing new agricultural technology and adjusting to climate change, given the inevitable consequences of climate change on agricultural productivity. Unfortunately, since the climate crisis is a complicated issue requiring coordinated efforts from numerous countries and, in fact,

3.0 various sectors of any nation's economy, such as transportation and environmental management and development through the provision of necessary infrastructures, the agricultural sector alone cannot effectively combat it. Climate change adaptation and mitigation are two examples of climate change resilience methods that need to be appropriately coordinated. Adoption of technology that aid in coping with climate change and changes to socioeconomic processes are examples of adaptation. In agriculture, this entails creating animal breeds and crop kinds that can tolerate the increased weather fluctuation without appreciably lowering the intended production output. It may also take the shape of precise agricultural and animal management techniques, as well as the building and installation of the infrastructure required, such as cutting-edge greenhouses, storage facilities, and transportation hubs. Agronomists and breeders have created a number of improved crop varieties over the years, including those with short generation times that guarantee drought escape and those with drought-tolerant genes that allow them to withstand low soil moisture levels without suffering appreciable yield loss.

4.0 Additionally, high-yielding, disease-tolerant, and nutritionally enhanced varieties have been created (Fakorede and Badu-Apraku, 2017). Although this endeavor is really admirable, in order to get the intended outcomes, it must be integrated with contemporary climate smart infrastructures. On the other side, mitigation entails lowering GHG emissions as well as initiatives like afforestation that lower the concentrations of GHGs already released into the atmosphere. In order to effectively manage the effects of climate change and guarantee food security, both adaptation and mitigation must be handled seriously.

1.0 CLIMATE CHANGE AND COVID-19 IMPACT ON AGRICULTURE

2.0 For millions of individuals worldwide, agriculture serves as their main source of income in addition to providing food and sustenance. The climate problem poses many, multifaceted, and interrelated risks to agricultural and food systems. Changes in temperature, precipitation, severe weather, pests, and illnesses are some of the ways that climate change impacts the circumstances of food production. The COVID-19 pandemic is a health emergency that has made the effects of climate change on all food systems worse. Because agricultural production, transportation, and processing have a variety of effects on human health and climate conditions, they can potentially accelerate the spread of infectious and zoonotic diseases like the corona virus (Dobson et al., 2020). As a result, there is a direct or indirect connection between COVID-19 and climate issues. The environment is essential to agriculture. Agriculture may have an impact on the environment by contaminating the air and water and generating greenhouse emissions, even though it is vital for producing food and supplying the nourishment required to preserve human health (von Braun, 2017). A degraded environment may have an impact on public health and raise health care costs, which can then have an impact on food production and agriculture (Wu et al. 2016). However, ecologically friendly agriculture and food systems may reduce greenhouse gas emissions, enhance public

health, and increase agricultural systems' potential for future productivity (Barbier, 2020). Thus, there are direct or indirect connections between agriculture, food, coronavirus infections, and climate change. interacting and exacerbating climate change's problems (Rasul, 2021).Agriculture and food systems are impacted by both COVID-19 and climate change, however the ways in which they do so differ (Schmidhuber et al., 2020). While the effects of COVID-19 are abrupt, spread quickly, and pose serious hazards right now, the effects of climate change develop gradually over time and have long-term effects that endanger human health and well-being as well as the basic foundations of agriculture. Higher temperatures, variations in rainfall and precipitation, and related severe weather events like droughts and floods, as well as pests and diseases, are some of the ways that climate change is affecting agriculture (Rana and Moniruzzaman, 2021; IPCC, 2019). Increased heat stress, the ease with which infectious illnesses may spread, and severe weather are all ways that climate change impacts public health (Watts et al., 2020).

An integrated strategy to addressing food security in the context of the pandemic and climate change is necessary because of the connections between COVID-19 and climate change. The problem of food security, public health, and climate mitigation cannot be successfully and sustainably addressed unless food, public health, and climate change are considered together. To maximize synergies and reduce compromise between food production and climate adaptation and mitigation, public health and climate change must be tackled holistically. In order to make agriculture and the food system climate-smart and pandemic-smart, emphasis must be placed on making them climate-sensitive and public health-friendly, producing wholesome food in an environmentally sustainable manner (The Lancet, 2020).

1.0 INNOVATIONS IN AGRICULTURE IN RESPONSE TO CLIMATE CHANGE AND COVID-19 PANDEMIC

2.0 Food insecurity has lately become worse due to the pandemic, which has exacerbated the problems with food security brought on by climate change. The detrimental effects of COVID-19 on the world economy may also raise the possibility of faster population increase, which might put more strain on the scarce food supply. Agriculture and food production have changed as a consequence of several reactions to the epidemic, and these changes may last in the long run. In some cases, automation of food production and processing is prioritized in order to reduce the risks associated with utilizing labor that could not be available owing to sickness or restrictions on labor migration. This might lead to increased investment in harvesting and processing automation, reducing the number of manual stages in the whole supply chain. The possibility of food contamination during manufacturing may also be eliminated by the automation of food production in these systems. Food contamination by COVID-19 has not been an issue, but in future pandemics, other microbes may provide this concern (Henry, 2020). The delivery of the productivity improvements necessary to guarantee food security might be greatly aided by the accelerated deployment of enhanced crop types employing cutting-edge genetic technology. The need for crop management innovations via agricultural technology developments, which has lately been fueled by the need to adapt to climate change, has become even more urgent due to the epidemic. If paired with protected cropping, gene editing technologies might lead to very quick advancements in food production and have a greater chance of being accepted and understood than previous genetically modified methods. Genetics may concentrate on improving the food products' nutritional content and consumer appeal by using controlled conditions for food production (FAO, 2020). Greenhouse farming technology has been regarded as one of the technologies that may readily close the food gap. This agricultural method makes it possible to produce more high-quality goods throughout the year (Ibirogba and Wada, 2019). Nigeria has extremely few green house facilities, with Taraba, Ogun, and Lagos having the best.

3.0 Edo State and Kaduna. The combined area of all these facilities is less than 2,000 hectares, but Mexico has greenhouse facilities covering over 50,000 hectares of land, which has only led to their export of food to other nations. In addition to lessening the detrimental effects of climate change on agriculture, the utilization of controlled environments will provide alternative food sources that will stop ongoing conflicts between Nigerian farmers and illegal herders. Nigeria is thought to be able to fulfill her food needs and sell to other nations using greenhouse technology (Ozioruva, 2021). Carefully implementing hydroponic technology is essential to the greenhouse's success. Achieving sustainable development objectives in terms of food security and a successful green revolution throughout the year depend on irrigation. Just 45% of the 2.0 million hectares of irrigation potential are now being used. Seventy percent of the country's irrigation potential is found in the

northern region, which receives very little rainfall on average, twenty percent is found in the humid south, and the remaining portion is found in the middle and western plateau regions. The nation has vast irrigation potential, with dam projects scattered around the nation. On the other hand, most government-built dams are either abandoned or underused for irrigation. About 264 dams totaling 33 billion m3 of water may be stored in Nigeria for a variety of uses, including irrigation, hydropower, fisheries, and ecotourism. Of these, 210 are held by the Federal Government, 34 by the States, and 20 by private groups. Together, these dams have created over 350,000 hectares of development-ready irrigable land in the surrounding areas. Additionally, there are 27 tiny earth dams in operation around the country, totaling 2,700 hectares of potential irrigable land. Studies have shown that irrigated agriculture generates much higher agricultural productivity than rainfed agriculture. To provide the necessary framework for sustainable irrigation development, foster an atmosphere that is conducive to it, and encourage private sector investment in irrigation development, the Nigerian government must collaborate with the Food and Agriculture Organization (Adelodun and Choi, 2018).For plant-specific and animal-specific production, precision agriculture (PA) is an agricultural automation approach that mostly depends on electronics, information technology, and communications in addition to technical know-how and labor. Another name for precision agriculture is a kind of farm management that uses information technology (IT) to make sure that soil and crops get precisely what they need to flourish and produce at their peak. In order to optimize agricultural returns while minimizing chemical usage and safeguarding the environment, precision agriculture enables the appropriate quantity of input (fertilizer, pesticide, water, crop, etc.) to be administered at the precise time and location. According to Abdulhamid and Afunlehin, precision agriculture is necessary for a number of reasons, including evaluating and controlling field variability, doing the right thing at the right time and place, enhancing production, boosting input effectiveness, and making the most use of the least amount of land possible.

4.0 2019). Information (soil, crop, and climate databases), technology (Global Positioning System (GPS) receivers, Differential Global Positioning System (DGPS), Geographic Information Systems (GIS), remote sensing, Variable Rate Applicator, and Combine Harvesters with Yield Monitors), and management (information management, decision support system (DSS), identifying a precision agriculture service provider) are all components of precision agriculture. Precision agriculture has made farming easier, but most Nigerian farmers have not used it, which has made solving issues with soil, crop conditions, and climate change challenging. In Nigeria, precision agriculture has been seen as an idea without any realization (Adekunle, 2013). High application costs, a lack of technical know-how, a variety of planting methods, and market imbalance are some of the disadvantages of precision agriculture in Nigeria. The advantages of precision agriculture exceed these implementation difficulties since it is both economically and ecologically sustainable (Abdulwaheed, 2019). Nigeria, like other nations across the globe, needs to embrace climate smart/precision agriculture more in order to properly address the several issues stated above. These are procedures and facilities that are now very rare in Nigeria. Mono-seasonal crop production with a strong reliance on rainfall is a major feature of Nigeria's agricultural system. Due in part to weather-driven variations, the yield of most crops is thus lower than what is obtained in other nations with more sophisticated systems. While the need for food has significantly increased due to the growing human population, the amount of agricultural land has decreased as a consequence of rapid urbanization (EKSPOLY, 2022). The nation's food security is negatively impacted by these causes as well as the COVID-19 epidemic and climate change. In order to efficiently increase production per unit area of the continuously shrinking agricultural land regardless of the season and minimize the waste of limited and rather costly agricultural inputs, it is therefore practical to fully implement various technologies to enable precision agriculture. The public's quick embrace of the use of science and technology to transform Nigerian agriculture and improve food security may be attributed to the need of responding to the epidemic. The public's quick acceptance of using science and technology to promote food security may be influenced by the necessity to react to the epidemic (Henry, 2020). In the post-pandemic period, crop management innovation tactics may be useful in mitigating the adverse effects of climate change. These strategies will be supplemented by ongoing efforts to provide traditional subsistence farmers with suitable extension, policy, and agro-technology transfer.

2.0 CONCLUSION

Food security and agricultural productivity are being negatively impacted by climate change due to its many direct and indirect effects. The current worldwide COVID-19 epidemic exacerbates the problem. In order to ensure people's food and nutrition security as well as their lives and livelihoods, the COVID-19 problem requires very aggressive and immediate initiatives. In the post-pandemic period, crop management ideas and execution are successful in tackling the climate change challenge. Therefore, in order to support and improve food security despite climate change and the COVID-19 pandemic, the government, farmers, and stakeholders at all levels of the various economic sectors must embrace crop management innovations and climate smart technologies and increase investment in agricultural research and development.

REFERENCES

[1] Agboola, J. O., Oyetunde, O. A., and Adeboye, K. A. (2021). A evaluation of improving the seed system for food security in the light of COVID-19 and climate change. Adebooye, O. C., and Adeyemo, S. M. (Eds.) Sustainable food and health systems in light of the COVID-19 pandemic and climate change. Proceedings of the DAAD Alumni Event, March 28–31, 2021, Obafemi Awolowo University, Ile-Ife, Nigeria, pp. 46–49. [2] I. O. Adekunle (2013). Nigerian agriculture may benefit from precision agriculture. Journal of Scientific Research in the Middle East, 13(9), 1230-1237.[3] Choi, K. S., and Adelodun, B. (2018). An overview of Nigeria's irrigation practice assessment, including its past, present, and future potential. 13(40), 2087-2097, African Journal of Agricultural Research.

[4] Abdulhamid, I. and Afunlehin, O. (2019). Nigeria Needs Precision Agriculture. [5] Onifade, A. O., and Abdulraheem, M. I. (2021). Conference: 2021 Seminar, Fourth School of Vocational and Technical Education. In Lanlate, Nigeria. [6] Abdulwaheed, A. (2019). The advantages of precision agriculture in Nigeria. https://www.researchgate.net/publication/354153714. 19(2), 29-34, London Journal of Research in Science: Natural and Formal. [7] ATPS (2013) African Technology Policy Studies Network. ATPS Working Paper No. 79, "Agricultural Innovations and Adaptations to Climate Change Effects and Food Security in Central Africa: Case of Cameroon, Equatorial Guinea, and Central Africa Republic" (Musongong née Siri Bella Ngoh, Mafany George Teke, Ndeso Sylvevster Atanga). [8] Adeboye K. A. and T. M. Awopegba (2021). investigating plant genetic resources to improve food and nutrition security during the epidemic. Third International Conference Proceedings, Center for Research, Innovation, and Development (CRID) FPA. [9] Badu-Apraku, B. and M. A. B. Fakorede (2017). https://cridpublications.fedpolyado.edu.ng/images/crid2021proceeding.pdf. "Morphology and physiology of maize," Springer International Publishing Company, Gewerbestrasse 11, 6330, Chan, Switzerland, "Advances in genetic enhancement of early and extra-early maize for sub-Saharan Africa," pp. 33–53. [10] E. B. Barbier (2020). Greening the G20's post-pandemic recovery. Environ. Resour. Econ. 76, 685–703. [11] Dianita, R., Koyum, M., Wiranto, W., Ubaidillah, U., and Devitriano, D. (2022). The percentage of sawdust used as carbon sources in rabbit manure compost to boost Pennisetum purpureum cv. Mott growth. Animal Science Bulletin, 46(2), 126-131.[12] Dixie, S. (2016). Fertilizing using rabbit dung. Extension of Michigan State University. [13] Dobson, A. P., Stuart, P., Lee, H., Kaufman, L., Ahumada, J. A., Ando, A. W., Bernstein, A., Busch, J., Daszak, P., Engelmann, J., Kinnaird, M., Li, B., Loch-Temzelides, T., Love-joy, T., Nowak, K., Roehrdanz, P., Vale, M. M., (2020). Economics and ecology to avert pandemics. Science, July 24, doi:10.1126/science.abc3189. [14] EKSPOLY (2022). youth and farmers' capacity development in climate-smart agriculture. The Central Bank of Nigeria Tertiary Institution Entrepreneurship Scheme (CBN TIES) received a proposal from the Ekiti State Polytechnic. February of 2022. [15] Onyekuru, A. N., and Enete, A. A. (2011). Empirical data from Southeast Nigeria demonstrates the difficulties in agricultural adaptation to climate change. Tropicultura Journal, Vol. 29, No. 4, pp. 243-249. [16] FAO (2020). global food problem. [17] FAO, F. (2017) http://www.fao.org/worldfoodsituation/csdb/en/. Agriculture and food in the future: trends and issues. Annual Report, 296, 1–180. [18] FAO (2015). FAO Climate-Smart Agriculture Success Stories http://www.fao.org/3/a-i3817e.pdf [19] Fayose, C. A., Fakorede, M. A. B., Badu-Apraku, B., and Abebe, M. (2022). In Southwestern Nigeria's rainforest, weather conditions have an impact on maize canopy orientation. The London Journal Press is reviewing the manuscript.

[20] Henry R. (2020). Agricultural and food supply innovations in reaction to the COVID-19 pandemic. 1095–1097 in Molecular Plant, 13(8). https://doi.org/10.1016/j.molp.2020.07.011.