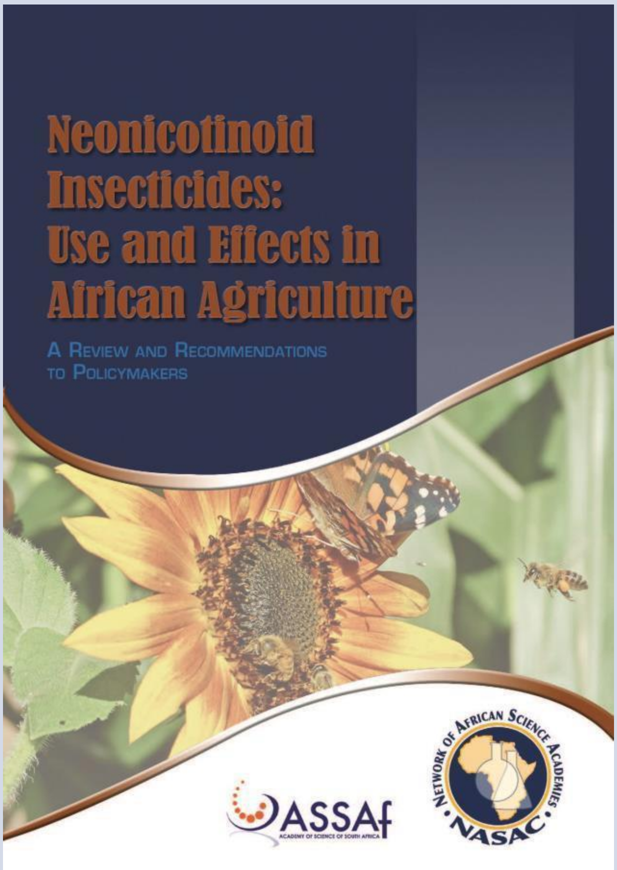

PROCEEDINGS REPORT

Virtual Event on

Neonicotinoid Insecticides:
Use and Effects in African Agriculture
A Review and Recommendations to Policymakers

18 November 2020

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Academy of Science of South Africa (ASSAf)
PO Box 72135, Lynnwood Ridge, Pretoria, South Africa, 0040
Tel: +27 12 349 6600 • Fax: +27 86 576 9520
E-mail: admin@assaf.org.za

The Academy of Science of South Africa (ASSAf) was inaugurated in May 1996. It was formed in response to the need for an Academy of Science consonant with the dawn of democracy in South Africa: activist in its mission of using science and scholarship for the benefit of society, with a mandate encompassing all scholarly disciplines that use an open-minded and evidence-based approach to build knowledge. ASSAf thus adopted in its name the term 'science' in the singular as reflecting a common way of enquiring rather than an aggregation of different disciplines. Its Members are elected on the basis of a combination of two principal criteria, academic excellence and significant contributions to society.

The Parliament of South Africa passed the Academy of Science of South Africa Act *(No 67 of 2001)*, which came into force on 15 May 2002. This made ASSAf the only academy of science in South Africa officially recognised by government and representing the country in the international community of science academies and elsewhere.

This report reflects a summary of the proceedings of the Neonicotinoid Insecticides: Use and Effects in African Agriculture. A Review and Recommendations to Policymakers virtual event held on 18 November 2020.

Views expressed are those of the individuals and not necessarily those of the Academy nor a consensus view of the Academy based on an in-depth evidence-based study.

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List of Acronyms

AASSA	Association of Academies and Societies of Sciences in Asia
AITL	Acute Insecticide Toxicity Loading
AMASA	Annual Meeting of African Science Academies
ASSAf	Academy of Science of South Africa
CRIG	Cocoa Research Institute of Ghana
EASAC	European Academies' Science Advisory Council
EPA	Environmental Protection Agency
EU	European Union
FAO	Food and Agriculture Organisation
IANAS	InterAmerican Network of Academies of Sciences
IAP	InterAcademy Partnership
ICIPE	International Centre of Insect Physiology and Ecology
IPM	Integrated Pest Management
NASAC	Network of African Science Academies
SADC	Southern African Development Community
US	United States
WIA	World Impact Assessment

Background to the Virtual Event

Agriculture is critically important for African societies and economies but ensuring food security for Africa's growing population is a major challenge. One particular concern are pesticides called 'neonicotinoids', which render all parts of a plant toxic to all insects and contaminate the soil and water bodies. By exposing all organisms to the toxins, neonicotinoids also harm beneficial insects that provide many important 'ecosystem services', such as pollination, soil development, and natural pest control, which are an integral part of sustainable agriculture. Neonicotinoids have contributed to the loss of ecosystem services from pollinators and other insects in Europe and elsewhere, and several of them have been banned in the (European Union) EU and other countries due to their harmful effect on beneficial insects. Africa, with its rich biodiversity and heavy reliance on agricultural production, is one of the fastest-growing pesticide markets in the world, so protecting it from the harmful effects of neonicotinoids is vital to ensuring a sustainable agriculture that provides food security.

The Academy of Science of South Africa (ASSAf), in collaboration with the German National Academy of Sciences Leopoldina and the Network of African Science Academies (NASAC) has recently completed a project exploring the use and effects of neonicotinoids in African agriculture. This project brought together experts from 17 African countries, reviewed the relevant African scientific literature, and analysed the state of knowledge on neonicotinoids and their impact on ecosystem services for agriculture and on biodiversity in Africa. The resultant report 'Neonicotinoid insecticides: use and effects in African agriculture. A review and recommendations to policy makers' (NASAC, 2019) has collated an unprecedented amount of information, identified gaps in scientific knowledge and research relating to neonicotinoids in Africa, and developed key recommendations from science to policy-makers to ensure the sustainability of African agriculture and thus food security.

One year after the launch of the NASAC report, the purpose of this virtual event was to introduce the report, including an update on recent global scientific and African policy developments regarding neonicotinoids, and to discuss its implications with a wide range of stakeholders, with the aim of stimulating policy and research action on this important issue. The target audience and participants included South African and Southern African Development Community (SADC) policymakers, regulatory agencies, government departments, agricultural associations, extension-service providers, research institutes, international development agencies, representatives of embassies, and other interested stakeholders.

1. Welcome and Introductory Remarks

Prof Himla Soodyall, ASSAf Executive Officer, welcomed participants and recounted the origins of this project, which trace back to a meeting between the European Academies' Science Advisory Council (EASAC) and ASSAf representatives in Jordan several years ago. She particularly thanked Prof Volker ter Meulen for being the engine behind this project, the funders, NASAC and the ASSAf and Leopoldina collaborators in making this event happen. She noted that the policy makers booklet was first launched at the 2019 Annual Meeting of African Science Academies (AMASA) held in Ghana and was due to be launched in South Africa in March 2020, but this launch had to be postponed due to the COVID-19 pandemic. Thus, the current virtual event served to introduce the report, including an update on recent scientific and policy developments regarding neonicotinoids in Africa.

Prof Masresha Fetene, Co-chair of the InterAcademy Partnership (IAP) welcomed participants and thanked ASSAf, the Leopoldina, NASAC and EASAC for organising this meeting. Prof Fetene explained the structure of IAP, which includes the regional networks EASAC, NASAC, InterAmerican Network of Academies of Sciences (IANAS), and Association of Academies and Societies of Sciences in Asia (AASSA). All regional networks, and IAP as an overarching organisation, aim to produce evidence-based solutions to the world's most challenging problems. He noted that IAP harnesses the expertise of the scientific and medical community to advance policies, promote science and education as a critical developmental goal. Prof Fetene noted that the current project was inspired by the 2015 EASAC report 'Ecosystem Services, Agriculture and Neonicotinoids'. The EASAC report was influential in informing EU policies on neonicotinoids. Another example is IAP's recent work on food and nutrition security and agriculture, which also contains some chapters on pesticides.

Mrs Jackie Kado, Executive Director of NASAC welcomed participants and gave a brief overview of NASAC and its member academies. NASAC was established to collectively offer authoritative science advice in the continent using available expertise and to engage the available structures and frameworks in place. NASAC believes that science is essential to the economic, social and cultural development of Africa. Correspondingly, NASAC activities are continually geared towards assisting its membership make the voice of African science heard by African decision-makers and decision-makers worldwide; and supporting its membership to contribute to science and technology capacity enhancement in all African countries.

2. Presentations

Presentations were made as follows:

- Presentation of the NASAC report and an update on scientific literature on neonicotinoids since its publication by Prof Michael Norton, EASAC Environment Programme Director
- Presentation on the incidence of neonicotinoids and other chemicals of emerging concern in different environmental matrices in Kenya by Prof Torto Baldwyn, International Centre of Insect Physiology and Ecology (ICIPE)
- Presentation on recent findings on neonicotinoid use in Ghana by Dr Enock Dankyi, University of Ghana

Full audio recordings available upon request and consent of the speakers.

3. Open Discussion

Questions were submitted by participants during the registration process and via the chat function during the event and presented by the moderator to the expert panel consisting of Prof Mike Norton and working-group members Prof Baldwyn Torto, Dr Enock Dankyi and Prof Christian Pirk (University of Pretoria, South Africa). The responses presented below are consolidated replies by the expert panel.

1. Question: **Worldwide, which of the neonicotinoid insecticides have been banned and restricted for use and which are still in use, where and for what use?**

Response:

- European restrictions are limited to named active ingredients (Imidacloprid, Clothianidin and Thiamethoxam), this restriction limits them to indoor use e.g., greenhouses. Outside of the EU a province in the Philippines has prohibited these ingredients to protect growers of decorative butterflies and at some point, Ontario in Canada was introducing restrictions. Besides these, there are no specific bans on this class of insecticides, and they are subject to whatever local regulations national or regional authorities may apply to them. There is a relatively wide range of possibilities of manipulating various molecules and various approaches to achieve the same biological impact of blocking the neural pathways of insects, and that has led to the introduction into the market of some additional products which still might have the same negative side effects as neonicotinoids. This is an inherent problem of the regulatory systems in Europe and elsewhere as they have not been able to adapt to the particular blend of toxicity and leakage into the environment and bioaccumulation over time. Thus, there is still work to be done in adapting the regulatory system to conduct a proper assessment of the costs and benefits of this class of molecules.
- Looking at the South African perspective and how many pesticides are registered, there are over a hundred insecticides which have neonicotinoids as the active ingredient and there could be the same number in pesticides. Everyone can go to their local nursery and check the active ingredients, so I don't think that there is a huge ban in that direction from the regulatory point of view, which is debatable as to whether it is right or not.
- In Kenya the ban is very minimal, mainly due to a lack of data, however, work is being done towards collecting data to support decision making. Otherwise, most farmers use neonicotinoids indiscriminately and that is why in the presentation on 'the incidence of neonicotinoids and other chemicals of emerging concern in different environmental matrices in Kenya', one notices that neonicotinoids get washed away and end up in adjacent streams and that is of concern. However the regulatory authorities require data and that is what should be encouraged, making data available to support decision making.
- The situation in Ghana is similar to that in Kenya in that regulatory authorities require data and are specifically calling for local data to make decisions.

2. Question: **Since neonicotinoids are banned in Europe, how are manufacturers still permitted to sell them in Africa?**

Response:

- Regulatory decisions are taken at a national level. The EU regulatory decisions are only one part of the data input that national regulatory agencies consider, some countries rely more on the Food and Agriculture Organisation (FAO) or the United States (US) Environmental Protection Agency (EPA) who have not taken similar restrictions and so there is a lot of room for different conclusions depending on what data source is used. Also, national regulatory authorities may be of limited capacity and have limited ability to make their independent judgements and many of them rely heavily on the data provided by the manufacturers. These are a few factors contributing to the different approaches in different countries.

3. **Question:** **How can we manage the use of neonicotinoid insecticide to protect the environment?**

Response:

- Any insecticide, be it neonicotinoid or any other class of insecticide, must be used within the context of integrated pest management (IPM). Based on the presentation on 'recent findings on neonicotinoid use in Ghana' you realise that neonicotinoids have had the greatest impact on natural enemies within the agricultural ecosystem and natural enemies are important for biological control and must be preserved. So, it is important that we use appropriate doses that would not impact negatively on natural enemies, and also use other components within the IPM setup e.g., sanitation and various other techniques. The main concern for neonicotinoid use and protection of the environment is the prophylactic use of neonicotinoids indiscriminately. Most farmers are not trained properly on using pesticides, and that is why it is not only a matter of training but training to embrace the concept of IPM.
- I don't think science would say do not use insecticides to attack pests but the concept of IPM is that there are a whole range of options available to farmers before they need to resort to chemical pesticides e.g. hygiene and local knowledge. A workshop participant from Zambia (Professor Phillip O.Y. Nkunika, Associate Professor of Applied Entomology, University of Zambia) had done a lot of work on the use of indigenous knowledge to control pests and his work shows that it could be as or more effective than a chemical approach. The key point of IPM is that you use a targeted tool for a target pest, however this has been shifted substantially to almost reverse on its head by this concept of using the pesticides prophylactically. The rationale for prophylactic use is easy to understand in the sense that neonicotinoids are systemic, so when the seed grows, a proportion of that active ingredient does go into the crop so one can see the mechanism there, but when you look at the mass balance most of the active ingredient goes into the environment, which achieves an entirely negative purpose that must be weighed against the positive benefits on crop production.
- Some fairly recent research shows that this prophylactic use does not necessarily even achieve a significant increase in yield for many crops where it is applied. This work was mainly done in the USA on soybeans and corn, but they find that for the type of secondary and intermittent pests that are addressed by the systemic insecticides the avoided damage is relatively small, with only about 5% of pesticide effectivity compared to a non-treated crop. So, there is a big difference between the leakage into the environment and the benefits to the farmer. One way of dealing with this could be as is done in Italy. Here, farmers who no longer use neonicotinoid seed dressings pay a subscription to an insurance policy and if an occasional pest does reduce their yield to a certain level, then they get compensation through the insurance. This is really what the neonic is doing, it is giving the farmer an insurance. He/she is paying the premium through the extra cost of the dressed seed in the hope that this would make life easier, but the mass balance suggests that the premium the farmer is paying is rather high for the benefit that they are getting, and the Italian scheme has shown that to be the case. Farmers can pay a much lower fee into the subscription with a real insurance policy than they would in buying treated seeds.

4. **Question:** **Are we looking at the synergistic effects of some products that are being sprayed in combination with neonicotinoids: e.g., Atrazine is a product that reportedly triples the negative effect of acetamprid and imidacloprid?**

Response:

- That has been found in several studies and the potential mixtures of neonicotinoids with other insecticides and fungicides does add to the complexity of the assessment and generally increases the toxicity. The work mentioned in the report is on the combined effect of fungicides with neonicotinoids, which can substantially increase the toxicity.
- Sometimes we might not observe synergism or additive effects between the main active ingredients, but their breakdown products could also contribute and could even be more toxic. After protolysis one could get other breakdown products e.g., imidacloprid ends up with nine metabolites. The question is how do these metabolites interact with other pesticides that are out there? In Africa, a lot of work is required in this regard. In addition, another question remains whether we have the resources and the capacity to do the necessary research? The presentations show that both capacity and resources are lacking, only a few institutions can do the work. Thus, the private sector should contribute to ensuring that we all protect the environment and contribute to necessary research because the national governments do not have the resources and the capacity.

5. **Question:** **What will replace neonic seed treatments when it is gone? There is a huge grain market that all gets treated with clothianidin or thiamethoxam.**

Response:

- Dealing with the regulatory environment is always tricky. Regulations framed around pollinator protection would be helpful here, and the local member of Parliament might be able to advise on how to improve the pertinent regulatory framework, especially when pertaining to emergencies. The seed dressing market only came up in the last 20-30 years, so it is a relatively new market. Getting away from using neonicotinoids in a prophylactic way and rather applying IPM provides the alternatives is the priority objective. A study from North America showed that planting crops earlier had a significantly positive effect on yield compared to using neonicotinoids, so there are alternatives (see attached literature update). One just has to look for them, communicate and apply them. The alternative solutions might not be as easy as dressing seeds, but they might be more effective. There are alternatives, they are just not the blanket approach as seed dressings are.
- The IPM approach requires monitoring of pest threats and is more skill and labour intensive than just buying a bag of dressed seeds. Those skills and labour have perhaps been a casualty of the trend towards intensification and monetary-based productivity that has certainly driven European and American agriculture. Farmers have been trying to upscale, reducing their staff and increasingly relying on equipment and technology, which is not always compatible with the principles of IPM. If one considers the broader picture and starts including or at least considering non-target species that provide ecosystem services, it might encourage a return to precise targeting of real pests rather than a blanket insurance-based approach to pesticide usage. Of course, this requires reskilling some farms, providing the technology to assess the quality of the crop as it is growing, identifying pest threats, and then making targeted decisions, All of these are part of management

decisions that have been abandoned in the search for intensification and cost reduction that has been going on in some parts of the world.

6. **Question: How much of the environmental impact do you think can be attributed to off-label applications, or are these effects mainly due to the chemicals' properties regardless of the application?**

Response:

- I think it is both. We know that in Africa, particularly in Ghana, we have smallholder farmers whose knowledge of pesticides and farming practices is limited. Thus, they tend to over-apply these pesticides and that is a major concern in our part of the world. We have tried to address this by asking what would happen if we followed e.g. the advice on the label or the advice of the Cocoa Research Institute of Ghana (CRIG), and concluded that even following the advice does not necessarily guarantee that there would be complete protection of non-target species. For instance, in Ghana, pesticides are applied according to the calendar months, recommended by the CRIG. However, the CRIG's own studies suggest that the identified periods are not ideal as it does not reflect current pest dynamics. So even the recommendation itself is a challenge. Ghana has used this application regime since the ±1950's and it has not changed irrespective of the insecticide, the type (systematic or contact) or the chemical properties. Neonicotinoids are applied in cocoa farms mainly in the rainy seasons, which is a problem considering their high water solubility. So, to address the question directly, following the advice itself does not guarantee that non-targets will be protected. Extra measures e.g. the IPM approach, are the best way to minimise the effects on non-target species.
- Adding to the point of following the advice, when one looks at the producers' leaflets, some are suggesting that you use a particular pesticide/insecticide of a certain group to combat a given pest, and in addition, they recommend that you first remove the weed under the crop with a herbicide from a similar group of pesticide. This leads to interactions between pesticides. Therefore, in following the advice you are adding an interaction effect on which there is insufficient data to determine toxicity. Thus, even when one is following the advice there is not enough data to say that pesticide usage is safe.

7. **Question: What was the impact of the report on policies?**

Response:

- The report was launched at the Annual Meeting of African Science Academies in Ghana in November 2019, https://www.interacademies.org/news/neonicotinoid-insecticides-use-and-effects-african-agriculture . Representatives from the highest decision-making bodies were present at the launch, e.g., representatives from Ghana's EPA and the deputy director of the Cocoa Board in Ghana. Cocoa growers are major users of neonicotinoids in Ghana. So, for the very first time these authorities became aware of neonicotinoids and the challenges that they may pose to the environment and their ban elsewhere. The report brought neonicotinoids to the limelight, and as a result, the Ghana EPA is looking at local data to help make a decision on their registration or otherwise.

8. **Question:** **What about the impact of neonicotinoids on African bee species and other pollinators?**

Response:

- It is a good question that needs to be answered particularly in Ghana, because ±36% of our crop land is planted with cocoa. Ghana is the 2nd largest producer of cocoa and makes the best cocoa in the world. Neonicotinoids are thus the most-used insecticides. Currently, there are new formulations coming onto the market, which are combining neonicotinoids and Bifenthrin. Previously, farmers were alternating between Imidacloprid and Bifenthrin to help with cross-resistance. Now the formulations that have been approved are mainly for the two to be used together. This may introduce synergies etc. between active ingredients, and there is no data on the effects of such possible interactions on non-targets and the environment. So, considering that we spray ±36% of our land, even if bees may not be the major pollinators of cocoa, if you spray 36% of Ghana's crops you are bound to have exposure to bees in the environment, plus the possibility for leaching and runoff ensures that widespread exposure in the environment. The question about the effects of current pesticide application practices on the environment, including bees, needs to be answered as it is important for the continent.
- Sometimes it is good not to look at interactions in isolation. Even when one may not observe deleterious effects on bees, one can get accumulation of pesticides or their residues in bee products. For instance, we sampled honey from the markets in Kenya and found neonicotinoids in about 5 -15% of the honey samples. We also sampled bee pollen and we found neonicotinoids in 10-18% of samples. That gives us some information. We also find accumulation of neonicotinoids in beeswax, so when carrying out experiments and looking at the effects on bees, whether in the laboratory environment or the field, we should also be looking at bee products because bees are going to have long term exposure to these contaminants in the hive. This raises questions, for example, does long-term exposure to pesticide residues make bees more susceptible to some of the pathogens e.g., viruses and parasites? A lot of research has been done indicating that such synergy exists, mainly in the US and Europe. These and other questions, for instance do neonicotinoids affect the cognitive behaviour of bees, should be looked at within this continent and not only for one area, because we have many bee sub species on this continent e.g., within Kenya there are at least four bee sub-species. It is likely that their tolerance levels to neonicotinoids may vary. These are pertinent questions that need to be addressed in Africa when it comes to the interaction between neonicotinoids and bees and bee products.
- We did some work on dietary aspects and supposed detection of neonicotinoids in nectar by bees as well, and the data show that neonicotinoids affect perceived sweetness of floral nectar. So, in the context of food security, we might change the behaviour of our most important pollinators, and bees might not pollinate the crops we need. So, the effects may not only be in killing bees but might deter them from feeding on flowers, and thus pollinating them, as well. We also must keep in mind that we have a diverse insect community in Africa and, when looking at honeybees, we must consider that in Africa most of them are wild. Unlike in the global North, African bees are not in boxes, 95% of the bees are out there and cannot be moved away by beekeepers when an area is being sprayed. So that

makes the situation slightly different and should be taken into consideration when talking about pesticide applications and risk assessment in general.

9. <u>Question:</u> Surely the mode of application is very important in determining the likelihood of risk. There has been a strong emphasis on seed treatments but what about the applications to a tree crop post blossom as a root trench or trunk treatment?

<u>Response:</u>

- Work on sunflowers has shown that yield increases significantly if there are a lot of different pollinators around, which benefit from weeds growing in the fields as well. So, without the weeds, sunflower seed yield is also reduced. So, if there are pesticides that leak into the system and affect the weeds, this affects the pollinators as well. Thus, there are multiple facets that have to be taken into account when it comes to risk assessment. Regular periodic assessments might be a good start, but we need a more comprehensive approach to take pesticide leakage into account, especially if they are slowly accumulating in the soil.
- We are looking at pollinators and the agricultural system, and one conclusion from the presentation by Professor Torto is that 23% of field-adjacent streams (48 sites were sampled) had neonicotinoid concentrations exceeding what is considered to be safe. So, whether you apply it to the tree trunk or the blossoms, depending upon the season some of the pesticide will get washed away and gets into nearby streams, where it will accumulate to different levels. What is applicable in Kenya may be applicable elsewhere. If there are no streams nearby, the pesticides might end up leaking into the soil, with the amount of leakage depending on the season of application, the levels of application, and the know-how of the person applying it.
- While seed treatments have been emphasised in this discussion, not a lot of treated seeds are used in Ghana. However, research shows that only about 5% of what is applied in the seed treatment is taken up by the plant and 95% is leached into the environment. That high amount of leakage is the challenge. However, the current mode of application (foliar) in Ghana possess more risk, considering the potential exposure of neonicotinoids exposure to bees, insects, and leaching into the soil.
- The leakage into the aqueous environment is one of the least recognised side effects, yet there is some substantial work in Europe that shows that the leakage into aquatic systems from just routine usage can eliminate the population of key insect species, which provide the food stock for fish and birds. There is also some elegant work in Japan, a longitudinal study that started prior to the use of neonicotinoids. Examining areas adjoining rice cultivation, it showed that the leakage from neonicotinoid usage in rice fields into the lakes has reduced insects to the extent that the previously viable commercial fishery collapsed. So, this leakage into the water is a very important side effect and drenching soil is not helping in that context. The persistent systemic treatment of trees may have some advantages, but you need to consider the side effects on the natural insects which use that tree, particularly for pollination.

10. Question: **Are there other effective alternative insecticides and what does the future of neonicotinoids look like?**

Response:

- From our perspective we emphasised the negative effects of neonicotinoids, but we are not actually saying that neonicotinoids do not have a role in agricultural productivity and management. The message is that neonicotinoid usage needs to be considered alongside their negative effects in a much more comprehensive approach. We cannot say there is no future for neonicotinoids, but we will be encouraging the manufacturers to work with stakeholders and extension services to develop the best balance between the advantages of neonicotinoids while avoiding the disadvantages.

Additional pre-submitted questions

11. Question: **What is the current status of neonicotinoids in Africa and which crops will they still be allowed on?**

Response:

- This is a matter for regulatory authorities at the national level. Neonicotinoids are registered in almost all countries in Africa. In Ghana, they are mainly used in cocoa (~90%) but approved for cotton, vegetables, fruits, pulses, sweet potatoes and cotton. Similarly, neonicotinoids are approved for use on a wide range of crops in many countries in Africa.'?
- The NASAC report provides a lot of information to answer this question.

12. Question: **What are the key drivers of the proliferation of neonicotinoid insecticides in Africa?**

Response:

- One of the key drivers is the expectation of an increased pesticide-market growth in Africa as the pesticide market in other parts of the world appears to be saturating. We can see this in the pesticide-market reports, which identify Africa as a growth area. The trend to increase intensive agriculture with the aim of increasing productivity and relying more on exports rather than local sustainable farming is also a factor. There is also the increasing psychological dependence on pesticide input in agriculture. More information on this is available in the NASACreport.

13. Question: **The Is honey produced safe, give us the analysis results - hope they are available.**

Response:

- There is very limited data available but the results from African samples suggest similar levels of neonicotinoids of samples in other parts of the world. Human susceptibility to the insecticides is lower than insects and thus there is no suggestions up to now that the levels are harmful to humans. This is still an area where further work is needed, however, A recent study found neonicotinoids in 75% of the 200 honey samples from around the world. Levels of contamination are highest in North America (86%), followed by Asia (80%), Europe (79%), Africa (73%) Australasia (71%) and South America (57%).

- We have unpublished data for honey and pollen samples from Kenya. The frequency of occurrence of neonicotinoids in Kenyan honey ranges from 5 to 15% of samples. In pollen, it is 10-18% of samples.
- In Uganda, detection is mainly in Beeswax (see Amulen et al. 2019 PLoS One).

14. Question: Does the effect of neonicotinoids on bee poisonings get analysed?

Response:

- There is plenty of work done on the individual level on how neonicotinoids affect learning, gene expression etc. in bees, also in Africa.

15. Question: You mentioned research since the literature survey for the original report. Are there any results you would point to as particularly significant?

Response:

- Yes - the collapse of the aquatic ecosystem and associated fisheries based on some very detailed work in Japan. And the work that shows that Varroa mite and neonicotinoids are not separate threats but linked. Also the extent of contamination of aqueous environments. There are over 130 studies globally (if you search bee and neonicotinoids) – some of them address the interaction between different pesticides, the leaking into the environment etc. [See Appendix A for a list of scientific papers published since the publication of the NASAC report]

16. Question: What are the long-term effects of neonicotinoid insecticides on pollinators on various African crops and possible alternative bio-pesticides?

Response:

- There is a lack of information on this and should be an area of research.

17. Question: Do you think the benefits of neonicotinoids are greater than the effects that they cause in South Africa/ Southern Africa region?

Response:

- This would require research to firstly quantify any short-term benefits and weigh against wider and longer-term ecosystem effects.

18. Question: How is the state of neonicotinoid insecticides use in South Africa?

Response:

- Not sure whether anything changed since late 2018 (as reported in the NASAC report) – there are over 100 registered insecticides with imidacloprid as an active substance (the neonic found most in honey in Africa – Mitchell et al (2017)).

19. Question: What countries in Africa have documented negative effects on honeybees?

Response:

- There are studies, especially from South Africa, on the negative effects on honeybees, but if the question refers to the whole honeybee population of South

Africa, data is lacking. The lack of resources and capacity in most countries account for the lack of comprehensive information on the negative effects on honeybees.

20. **<u>Question</u>: I want more information regarding the influence of neonicotinoids would have on the ornamental market. Our product is a granular applied insecticide applied to the soil for home garden use on sucking insects as well as a seed coating and as a soil-applied drench.**

<u>Response:</u>

- This is the type of application that can be problematic due to the neonicotinoids' water solubility and leaching. The presentation on the indirect effects of neonicotinoids addresses this question.

4. Closing Remarks

Prof Michael Norton thanked all participants for joining the virtual event and for their participation. He thanked all the speakers for their contributions and the ASSAf and all partners for putting the event together. He noted the importance of agriculture, especially within Africa, given its high importance in economies and in rural communities. He noted that the NASAC report aims to inform the best management of those agricultures in a more sustainable manner. He hoped that the analysis produced will help extension services and manufacturers all working together as individual stakeholders to develop a more long-term sustainable model for the use of the effectiveness of neonicotinoid toxicological properties on pests, while still reducing or preferably eliminating the negative side effects that have emerged in the research over the last twenty years. So, on that basis Prof Norton noted that he hoped the report will encourage a dialogue that would continue between all relevant stakeholders and policy makers for the benefit of sustainable agriculture in Africa.

5. Appendix A: The NASAC Review of Neonicotinoids in Africa- update on scientific developments since publication, and impact

The review of the use and effects of neonicotinoids in Africa (NASAC, 2019) included scientific research published before 2019, which had provided overwhelming evidence of risks at the ecosystem level, as well as other issues including questions over the effectiveness of prophylactic treatment and emerging resistance. The review made a number of recommendations covering regulations and enforcement, the provision of independent advice to farmers, the role of IPM, and international support for sustainable agriculture. Questions were also cast over the objectivity of available advice to farmers.

Since the report was issued (November 2019), it has generated media interest, allowed some of the working group members to contribute to conferences, generated articles in peer-reviewed journals and impacted the policy discourse in some countries. Research has also continued, providing additional evidence on the matters covered in the report. Plans had been made to review outcomes and further disseminate the group's work during a workshop in Pretoria in March 2020, but this had to be cancelled due to the COVID19 pandemic. Instead, NASAC (supported by EASAC, IAP and ASSAf) have carried out a review the 2019 report's conclusions one year on from its release. In this paper, we record various impacts from the 2019 report and point to recent research results that have been published since our initial literature review was conducted in late 2018.

5.1. Update on scientific publications on neonicotinoids since late 2018

Although we have not attempted to conduct a full review of recent publications, just the initial 10 pages of Google Scholar entries from late 2018 for 'neonicotinoid' show papers on environmental contamination, toxicity, lack of specificity, synergistic effects with other pesticides (e.g. fungicides), effects on non-target organisms and on ecosystems. Also, on the effectiveness of neonicotinoid uses and their compatibility with IPM, as well as human impacts. As before, most research has come from Europe or the USA, but increasing attention is being given in Asia (China and Japan) - especially to the intake of neonicotinoids by humans. We include also here some papers describing work in Africa. While these results remain limited in geographical scope, the broader evidence on the behaviour of neonicotinoids in general remains relevant to Africa.

Environmental contamination

Some papers show the extent of leakage from the point of use to the surrounding environment. For instance:

- Transfer of neonicotinoids from agricultural use to large river systems observed in China. (Imidacloprid and thiamexotham were most often detected; Zhang *et al.*, 2019).
- Chen *et al.* (2019) analysed water from all sixteen rivers along the east coast of China for nine neonicotinoids. The results suggested use had shifted from old types (i.e., imidacloprid and acetamiprid) to new types (i.e., dinotefuran and nitenpyram) in some areas. The estimated annual quantity of neonicotinoids released into the adjacent seas totaled 1256 ± 780 tons, and 27% and 84% of the samples exceeded the thresholds for acute and chronic ecological risks respectively.
- Marine and estuary waters near the Seto Sea (Japan) were analysed with some containing imidacloprid and fipronil at levels exceeding the freshwater benchmarks for aquatic invertebrates (Hano *et al.*, 2019).
- Bonmatin *et al.* (2019) found neonicotinoids in soil (68% of samples), sediment (47%)

and water (12%) in a survey of Northern Belize. 31% of sediment samples may pose a risk to aquatic invertebrates by chronic exposure. Imidacloprid was the most common residue highest in melon fields and lowest in banana and sugarcane fields.

- 693 honey samples from across China (Wang at al., 2020), found that 40.8% of the samples contained at least one of the five neonicotinoids tested. The concentrations in honey overlapped with those that have been found to have significant adverse effects on honeybee health.
- Maize seed coating neonicotinoids occur in the guttation drops of common weeds nearby. Although the levels of these neonicotinoids were substantially lower in the guttation liquid of the weeds than in that of maize plants emerged from coated seeds, the compounds were detected up to 36th day after planting of the maize seeds (Mortl *et al.*, 2018).
- Sorption affinities of neonicotinoids in soils are mainly governed by organic carbon. Biodegradation did occur and their presence influenced the soil nitrifying process (Zhang *et al.*, 2018).
- Kandie et al (2020a), measured contamination by a range of chemicals in snails and sediments collected from 48 sites within the Lake Victoria South Basin, Kenya. Acetamiprid, and imidacloprid were present in the snail tissues in concentrations up to 27 ng/g ww and 21 ng/g ww, respectively.
- Kandie *et al.* (2020b) detected imidacloprid and its degradation product imidacloprid-guanidine at concentrations ranging up to 32 and 152 ng L^{-1}, respectively in freshwater systems within the Lake Victoria South Basin, Kenya.
- Assad *et al.* (2017) used mosquito larvae as a bioindicator in bioassays of Okra fruit wash water, and showed levels below the ADI for malathion and cypermethrin, but above the ADI for imidacloprid residues.
- Mineau (2019) found exponential growth in neonicotinoid use in New York State and increased contamination in aquatic systems, loss of invertebrate life with ecosystem-wide perturbations affecting consumer species such as insectivorous birds, bats, fish, and other vertebrates.
- Mineau (2020) reviewed data on California's aquatic systems and found that some in agricultural areas using neonicotinoids contained levels of imidacloprid exceeding ecological damage levels set by the USEPA by factors of 10 to 100.
- Imidacloprid and fipronil found in majority of English rivers at concentrations often exceeding chronic toxicity limits. Sources postulated to be prophylactic pet treatments for fleas (Perkins *et al.*, 2020).

Sub-lethal and synergistic effects

In addition to the extensive work already published on bees:

- Straub *et al.* (2020) show that neonicotinoids and ectoparasitic mites act synergistically to weaken honey bee colonies and contribute to colony collapse.
- Two literature reviews (Harwood and Dolezal, 2020; O'Neill *et al.*, 2018) document the harmful interactions between pesticides (including neonicotinoids) and immunity to pathogens and parasites.
- Paleolog *et al.* (2020) showed the effects of imidacloprid may affect proteolysis, aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, and global DNA methylation in honeybees.
- Willow *et al.* (2019) provide further evidence of the significance of synergistic effects between neonicotinoids and fungicide when co-applied. The general reinforcing effect from multiple stressors also features in Wade *et al.* (2019).
- Synergistic effects recorded of thiamethoxam with other pesticides (λ-cyhalothrin, β-cypermethrin and abamectin) by Wang *et al.* (2020) and imidacloprid with miticide thymol (Colin *et al.*, 2020).
- Crall *et al.* (2018) show that neonicotinoid exposure disrupts bumblebee nest behaviour, social networks, and thermoregulation.

Non-target species and whole ecosystem effects

Work has continued on effects on non-target species and on ecosystems as a whole. Recent papers on the effects on beneficial insects, on mammals and on ecosystems includes:

- Calvo-Agudo *et al.* (2019) show that honeydew is an important route for exposure by beneficial insects that are predators for aphids, mealybugs, whiteflies, or psyllids.
- Barmentlo *et al.* (2019) show that environmental levels of neonicotinoids reduce prey consumption, mobility and emergence of the damselfly *Ischnura elegans* and indicate neonicotinoids play a central role in the Odonate decline in general.
- Eng *et al.* (2019) show sublethal effects on white-crowned sparrows, that lose weight when given field-realistic does of imidacloprid-treated seeds, delaying migration.
- Wu *et al* (2020) show neurological effects on the echo-location ability of bats.
- Yamamuro *et al.* (2019) studied the collapse of two commercial fisheries on a Japanese lake following the introduction of neonicotinoid use, and attributed this to the loss of zooplankton biomass resulting from the use of the insecticide.
- Cavallaro *et al.* (2019) examined the multiple stressors affecting emerging aquatic insects in wetlands near neonicotinoid-treated canola in central Saskatchewan. Variables included neonicotinoid concentration, turbidity, vegetation disturbance, and continuity of a vegetative grass buffer zone. Higher neonicotinoid concentrations negatively affected insect emergence over time.
- Laboratory tests (Renaud *et al.*, 2018) showed chronic toxicity of the neonicotinoids thiacloprid and acetamiprid to soil invertebrates exceeded European Commission trigger values and point to risks to soil biota from thiacloprid and acetamiprid use.
- Macauley *et al.* (2019) found that imidacloprid and clothianidin exerted strong chronic toxicity effects on *Deleatidium* nymphs, whereas thiamethoxam was the least toxic.
- Li, Miao and Khanna (2020) found increased neonicotinoid use led to statistically significant reductions in bird biodiversity between 2008 and 2014, with average annual rates of reduction of 3-4%. The rates are 5-12% when the dynamic effects of bird population decline on future population growth are considered.
- Lennon *et al.* (2019) looked for correlations between neonicotinoid use and changes in the populations of 22 farmland bird species between 1994 and 2014 in England, but found no detectable correlation with dietary preferences (secondary effects of pesticide use on insect food supply were not considered).
- Ge at al. (2018) found that earthworms exposed to neonicotinoids (six types tested) responded by avoidance behavior; this and reproduction harm were observed at very low concentrations.
- Korenko *et al.* (2019) found that spiders were repelled from eating captured flies when these were contaminated with neonicotinoids.
- Řezáč *et al.* (2019) found that imidacloprid, thiamethoxam, acetamiprid and thiacloprid had adverse effects on the predation rate of spiders, with imidacloprid associated with the most severe effects. Even acetamiprid caused strong effects, despite being subject to less strict regulations in the EU because of claims of its negligible off-target toxicity.
- Oumaima *et al.* (2020) reviewed the use of insecticides (both neonicotinoids and other insecticides) and found use by some farmers to be excessive. Concerns were expressed over persistence in the environment and effects on soil microorganisms and aquatic organisms.
- Rosemann et al. (2020) confirmed direct mortality and morbidity of Cape spurfowl through ingestion of imidacloprid-treated barley seeds in South Africa.
- Schläppi et al. (2020) found neonicotinoid-exposed colonies of black garden ants showed a reduced number of workers and larvae indicating a trade-off between detoxification and fertility.

Regulatory process
Flaws in the regulatory system have been identified that lead to it being unable to properly evaluate the risks of neonicotinoids. Despite this, the regulatory system is resistant to change.

- Topping *et al.* (2020) point to the weaknesses in the regulatory systems based on managing risks through single-product, single-crop assessments. This provides insufficient ecosystem protection, and needs to move to a more holistic view.
- Sgolastra *et al.* (2019) point out that pesticide regulation failed to detect the ecological threats posed by neonicotinoids, due to properties such as high efficacy, long persistence, high systemicity, high mobility, and application versatility. A more holistic approach is needed.
- Sánchez-Bayo and Tennekes (2020) review evidence that neonicotinoid toxicity increases with exposure time as much as with the dose (time-cumulative toxicity). This pattern of toxicity, also found among carcinogenic compounds has far-reaching implications for the impacts on non-target organisms in both aquatic and terrestrial environments. Neonicotinoids are incompatible with IPM and regulatory assessments cannot be based solely on exposure doses but need also to take into consideration the time factor.

Human exposure
While mammalian toxicity is low compared with insects, some studies had shown neurological effects from exposure. Recent work has studied exposure:

- Ikenaka *et al.* (2019) showed that children living in communities where thiacloprid was used to control pine wilt disease were exposed to multiple neonicotinoids on a daily basis.
- Human exposure was confirmed with imidacloprid detected in 100% of urine samples from rural applicators (Tao *et al.*, 2019).
- Wong *et al.* (2019) detected residues of neonicotinoid pesticides in drinking water that had transformed through chlorination and alkaline hydrolysis during water treatment. Such metabolites and potential novel disinfection by-products during treatment are relevant to evaluating the potential impacts of neonicotinoids on human health.
- Tao *et al.* (2019) found that the concentration of imidacloprid in the urine of people in the vicinity of sprayed orchards (pesticide applicators, their family members, children nearby) significantly increased after a spraying event.
- Chen *et al.* (2020) found widespread contamination of vegetables by residue levels of multiple neonicotinoids. Imidacloprid and acetamiprid were most frequently detected with thiamethoxam and clothianidin increasingly found. Exposure was much lower than the current chronic reference dose, but risks should not be overlooked due to the ubiquity of neonicotinoids in food and the environment.
- Zhang *et al.* (2019) found in Hangzhou that foods such as carrots, green vegetables, baby cabbage, and apple were contaminated with up to 6 neonicotinoids. While daily intakes are below the current chronic reference doses, concern is raised over the health risk of neonicotinoids to children via dietary exposure due to their increased use and ubiquitous presence in fruits and vegetables.
- Ichikawa *et al.* (2019) report the first evidence worldwide of neonicotinoid exposure in new born babies in the early phase after birth, suggesting a need to examine potential neurodevelopmental toxicity of neonicotinoids and metabolites in human foetuses.
- Becker *et al.* (2020) found that selection pressure from contamination by imidacloprid (and diazinon) caused insensitive snails to dominate over their less tolerant competitors, increasing a pathway for transmission of Schistosomiasis.

- Bonmatin et al. (2020) found neonicotinoid residues in soil, water and people's hair in the Philippines. Imidacloprid was the most prevalent neonicotinoid found in soil and water (with highest in citrus groves), while thiamethoxam and imidacloprid were most prevalent in hair samples.
- A shift to a plant-based diet requires the risks from pesticide contamination to be addressed. Wyckhuys et al. (2020) conclude that food producers possess myriad safe, practicable and effective non-chemical alternatives to reduce chemical contamination of foods.

General Chemistry and Actions

Neonicotinoids have a different combination of properties than the insecticides they replaced, and comparing their overall burden on the environment with their predecessors is not straightforward. One paper attempt to quantify this:

- Di Bartolomeis *et al.* (2019)) use the measure of Acute Insecticide Toxicity Loading (AITL) to assess the relative environmental load of neonicotinoids. This has increased substantially (4-48-fold between 1992 and 2014) as a result of the combination of neonicotinoids' acute toxicity and environmental persistence. Such a significant increase contributes to declines in beneficial insect populations as well as insectivorous birds and other insect consumers.

Other papers explored molecular structure and interactions:

- Ihara and Matsuda (2019) examined the detailed structures on the molecules and receptors to identify the potential for research to deliver more selectivity.
- Matsuda *et al.* (2020) point to the complex interactions between neonicotinoids and receptors, so that different bee species can exhibit different effects. This makes extrapolation between species (e.g. honey, bumble and solitary bees) difficult.
- Pange *et al.* (2020) summarize the microbial degradation and biochemical mechanisms of neonicotinoids.

Effectiveness and alternatives

Further publications have emerged that provide evidence that some uses are neither effective in absolute terms nor cost-effective from the farmer's point of view. Also, that farmers are restricted in the choices they have whether or not to use neonicotinoids in prophylactic treatments. This suggests that the widespread prophylactic use of neonicotinoid treated seeds should be re-evaluated by producers and regulators alike:

- Mourtzinis S. *et al.* (2019) show that the widespread use of neonicotinoid seed treatment on soybean seed yield appears to have little benefit for most of soybean producers.
- Labrie G. *et al.* (2020) found that neonicotinoid seed treatments in field crops in Quebec are useful in less than 5% of cases. Given the very low level of pest-associated pressure and damage, they should not be used prophylactically.

Moreover, unnecessary use adds to the risks of resistance:

- Saeed *et al.* (2018) found in Pakistan that there was very high resistance to acetamiprid (433-fold) and imidacloprid (173-fold) in the crop pest *Dysdercus koenigii.*
- Fujii *et al.* (2019) studied resistance in the brown planthopper in East Asia and Vietnam. Initially this was with imidacloprid, but this had spread to thiamethoxam and clothianidin, but not to dinotefuran and nitenpyram.
- Makoni (2020) found that the increased use of clothianidin in indoor mosquito control had already led to increased resistance in mosquitoes in Cameroon, stirring fears its usefulness may be short-lived.

Recent reviews of alternatives include:

- Jactel *et al.* (2019) reviewed alternatives for each pest targeted by neonicotinoids

(120 crops and 279 pest insects). An effective alternative to neonicotinoid use was available in 96% of the 2968 case studies analyzed. In 78% of cases, at least one non-chemical alternative method could replace neonicotinoids, although further field studies were required for many non-chemical methods before they could be routinely used by farmers. The study identified the need to promote such methods through regulation and funding.

- Furlan *et al.* (2018) provide a comprehensive review of the literature on the use of systemic insecticides in pest management, effects on crop yields, and the development of pest resistance. A diverse range of pest management tactics is already available, all of which can achieve efficient pest control below the economic injury level while maintaining the productivity of the crops. Examples of frameworks for a truly sustainable agriculture that relies mainly on natural ecosystem services instead of chemicals are included.
- Frank and Tooker (2020) argue that current use patterns may actually be creating more risks than benefits and conclude that neonicotinoids should only be used when they will improve economic returns for farmers rather than corporations, and when risks can be minimized. (In line with Tooker *et al.* (2017)'s earlier paper pointing to the blanket application of neonicotinoids through seed treatment as being contrary to IPM, increasing environmental loadings and resistance while delivering negligible benefits to farmers.)
- Veres et al. (2020) assess the need for neonicotinoid-based management on major global crops: western corn rootworm in maize; wireworms in maize and winter wheat; bird cherry-oat aphid in winter wheat; brown planthopper in rice; cotton aphid and silver-leaf whitefly in cotton. The study identifies opportunities to advance applied research, IPM technology validation, and grower education to halt or drastically reduce our over-reliance on systemic insecticides globally.

An IPM strategy to control fall armyworm in Africa has been shown to be effective:

- Midega et al. (2018) showed high reductions (>80%) in larvae abundance and damage and higher yields (x2.7) in maize plots employing a push-pull system of an inter-crop that repels the moths and a border crop that attracts them.

Independence of advice

It has been pointed out (e.g. Tooker *et al.* (2017)) that educational materials guiding the use of pesticides are often sponsored or co-created by pesticide manufacturers, raising potential conflicts of interest. They pointed to the failure to consider negative ecosystem impacts of neonicotinoids at two sponsored webinars from the American Society of Agronomy. The same tendency can be seen in a statement issued in South Africa by Croplife SA (2018) and by Croplife Africa/Middle East (2019) in response to the NASAC report. These do not address the following concerns:

- Pollinators other than honey bees
- Beneficial insects other than honey bees
- Toxic effects other than immediate acute effects
- Cumulative and sub-lethal effects (even on honey bees)
- Solubility and spread into aqueous systems
- Ecosystem services
- Persistence in soils.

On the question of effectiveness, Croplife (2019) asserts that the evidence of limited effectiveness of seed dressings in some North American and European crops is not applicable to African conditions and crops. This could be a productive subject for further research to better enable a proper evaluation of the cost-benefit trade-offs involved.
Wyckhuys et al. (2021) urge FAO to maintain the role of pesticides to that of last resort in its collaboration with Croplife International.

In summary, the latest scientific literature reinforces the messages conveyed in the NASAC report issued in November 2019, and adds to the evidence that the uses of neonicotinoids need to be reduced and placed within the framework of IPM. Of particular note are the well documented ecosystem effects of Yamamuro *et al.*, and the demonstration by Straub *et al.* of the mechanisms through which neonicotinoids increase susceptibility to the Varroa mite (often referred to by companies as the main cause of honey bee losses).

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5.2. Impacts of the NASAC Report

Although undoubtedly incomplete due to limitations in data collection, the report triggered a wide range of media interests and follow up in conferences, academic publications and political action. A summary of available information follows.

Press coverage

Centre for Agriculture and Bioscience International: African scientists call for urgent action to control use of neonicotinoid pesticides: https://blog.cabi.org/2019/11/20/african-scientists-call-for-urgent-action-to-control-use-of-neonicotinoid-pesticides/

Afrik21: Scientists warn against neonicotinoid insecticides: https://www.afrik21.africa/en/africa-scientists-warn-against-neonicotinoid-insecticides/

Mail & Guardian: Africa must act on pesticide 'double standards': https://mg.co.za/article/2020-03-05-africa-must-act-on-pesticide-double-standards/

BizCommunity Africa: Europe-banned insecticide 'threatens Africa's food security': https://www.bizcommunity.africa/Article/410/650/198265.html

Water Briefing Global: Scientists warn insecticide putting African food security at risk: https://www.waterbriefingglobal.org/scientists-warn-insecticides-use-putting-african-food-security-at-risk/

Farmer's Weekly (South Africa): Call for neonicotinoid ban in Africa: https://www.pressreader.com/south-africa/farmers-weekly-south-africa/20191213/281835760581104

Farmer's Weekly (South Africa): 'This is a huge contribution to our economy…'

https://www.pressreader.com/south-africa/farmers-weekly-south-africa/20200223/281732681504210

Anti-Corruption Digest: Europe-banned insecticide 'threatens Africa's food security': https://anticorruptiondigest.com/2019/11/25/europe-banned-insecticide-threatens-africas-food-security/

allAfrica: Africa: Europe Has Banned Neonicotinoid Insecticides. Action Is Needed in Africa Too: https://allafrica.com/stories/202002060134.html

SciDevNet: Europe-banned insecticide 'threatens Africa's food security': https://www.scidev.net/sub-saharan-africa/environment/news/europe-banned-insecticide-threatens-africa-s-food-security.html

SciEx: Global Trends That Will Affect Neonicotinoid Usage in 2019: https://community.sciex.com/2019/03/15/global-trends-that-will-affect-neonicotinoid-usage-in-2019/

Archyde: Africa risks becoming a spillway for pesticides banished from Europe: https://www.archyde.com/africa-risks-becoming-a-spillway-for-pesticides-banished-from-europe/

International Support Network for African Development (ISNAD Africa): Agriculture Becoming a Threat for Environment: https://isnad-africa.org/2020/06/02/agriculture-becoming-a-threat-for-environment/

Publications in scientific journals/media

Norton, M., Phalane, K. and Hobbhahn, N. (2020): Neonicotinoids in Africa: Consistent continent-wide regulatory systems are essential for sustainable agriculture. Chemistry World10.09.2020. https://easac.eu/fileadmin/PDF_s/Journal_Articles/2020_Chemistry_World_Comment_neonicotinoids.pdf

Norton, M. and Torto, B. (2020): Lessons learned in Africa. Nature Sustainability 10.08.2020, https://doi.org/10.1038/s41893-020-0571-0

Hobbhahn, N, McGrath, P, and Norton, M (2020). Europe has banned neonicotinoid insecticides. Action is needed in Africa too. The Conversation Africa. 22.09.2020. https://theconversation.com/europe-has-banned-neonicotinoid-insecticides-action-is-needed-in-africa-too-130886 (read over 4,000 times).

Conferences and other events

Annual Meeting of African Science Academies (AMASA), in Accra, Ghana, 12.-16. November 2019, organized by the Ghana Academy of Arts and Sciences: Official launch of the report to approx 80 representatives of the African science academies, including panel discussion with Ghanaian policy makers and scientists. http://www.interacademies.org/58304/Neonicotinoid-Insecticides-Use-and-Effects-in-African-Agriculture

23 Annual meeting of the African Association of Insect Scientists (AAIS) in Abidjan, Cote Ivoire, 18.-22. November 2019: Presentation of the report to approx 100 African scientists

World Biodiversity Forum in Davos, Switzerland, 23-28 February 2020, organised by the international research network bioDISCOVERY, and the University of Zurich Research Priority Programme Global Chhange and Biodiversity. Presentations by Dr Enock Dankyi, University of Ghana, on 'Neonicotinoid Insecticides: Use and Effects in African Agriculture Neonicotinoid Insecticides: Use and Effects in African Agriculture' and 'Neonicotinoid Use and Impact on Ecosystem Services in Cocoa Production in Ghana'

SETAC North America 41st Annual Meeting, virtual, 15-19 November 2020: Presentation by Dr Enock Dankyi, University of Ghana, on 'African Agriculture, Neonicotinoid Insecticides use, and Impact: Using Science and Stakeholder Engagements to Inform Policy Formulation'.

Parliamentary action

The Academy of Science of South Africa has prepared a policy brief based on the NASAC report, which will be published if it receives parliamentary approval.

Integration with other initiatives

The NASAC report was included in the database of the United Nations Development Programme's Biodiversity and Ecosystem Services Network, including a news article on the BES-Net Website:
https://www.besnet.world/neonicotinoid-insecticides-use-and-effects-african-agriculture
https://www.besnet.world/active-post-trialogue-dialogue-continues-afica-around-pollinator-land-food-nexus

Fundraising for more research in Africa

SumOfUs fundraising campaign for research in Ghana to support calls for neonic bans with scientific evidence: https://actions.sumofus.org/a/chip-in-ghana-neonics-research