POSITION STATEMENT ON NEONICOTINOIDS AND BEES

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1. Introduction

CropLife South Africa (CLSA) represents the majority of agricultural remedy manufacturers and suppliers in South Africa. Many of its members are registration holders of agricultural remedies collectively known as neonicotinoids (or chloronicotinyl insecticides CNIs). According to CLSA's records, only one registration holder of one imidacloprid agricultural remedy is not a member of CLSA.

The CNIs that are currently registered in South Africa are:

a. Acetamiprid – 4 products.
b. Thiacloprid – 3 products.
c. Thiamethoxam – 6 products.
d. Imidacloprid – 18 products.
e. Clothianidin – 2 products.

Fipronil (4 products) is sometimes mentioned in the same context but it belongs to a different chemical group and is, from CLSA's perspective, NOT under the same discussion as the CNIs.

CLSA recognises the importance of the CNIs in modern agricultural practice. These active ingredients are registered on many crops in South Africa as seed dressings, soil drenches and foliar applications to control a large number of plant pests. They have replaced a number of intrinsically highly toxic insecticides that were generally used before the advent of CNIs and also offer a more environmentally compatible mechanism for plant pest management than simply doing foliar applications of large volumes of agricultural remedies.

2. Problem statement

Concerns have been raised in many countries about hypothesised negative impacts of CNIs on honey bee populations. According to some authors CNI play a major role in the so-called colony collapse disorder or other kinds of bee colony mortality, while other authors offered totally different reasons for this devastating phenomenon. The negative publicity has resulted in the restriction or suspension of registrations of certain CNI containing products in a few countries (France, Germany, Slovenia, Brazil and Italy). Negative sentiments have already spilled over to South Africa despite the fact that there are no major bee health or bee mortality issues reported in South Africa, and any evidence to substantiate claims about neonicotinoids being responsible for bee mortality, is seriously lacking in our country. Concerns raised in public, on the internet, in social media and between individuals include the following:

a. CNIs are translocated by plants to their flowers and end up in nectar and pollen, thus posing a threat to bees.

b. CNIs are also absorbed by weeds that grow in between crops, especially fruit orchards, and contaminate pollen and nectar of weeds. It poses a threat to bees that forage on weeds.

c. CNIs that are applied as foliar application on fruit trees contaminate flowers, pollen and nectar and therefore pose a direct dermal and oral intake threat to bees due to high concentrations at the time of application.

d. CNIs that are sprayed as foliar application are prone to drift when less than optimal atmospheric conditions prevail during application and impact on bees that forage in areas adjacent to those where CNIs are applied.

e. CNIs that are applied as seed dressings generate dust and can therefore drift off target to pose a threat to bees that forage in areas adjacent to the planting areas.

f. CNIs are applied illegally *via* aerial application and pose a direct threat to bees that forage anywhere close to the application areas.

g. CNIs are sold for and applied illegally (off-label) on crops for which these products are not been registered and pose a direct threat to bees that forage in such crops.

It is alleged that all of the above situations will have a negative impact on honey bees and the claim is therefore made that CNIs are largely to be blamed for the colony collapse disorder in honey bees.

3. CLSA's evaluation of allegations against CNIs.

CLSA's members that are registration holders of CNIs had a special meeting to discuss the concerns about CNIs and to evaluate it in the South African context. Registration holders have themselves been involved or had contracted field studies on CNIs to ascertain whether any of the allegations, especially regarding CNIs toxicity to bees in normal application situations, could be substantiated.

CLSA came to the following conclusions:

a. **Table 1.** Comparative oral and contact LD_{50} values of CNIs and other insecticides commonly used in South Africa (source: *The Pesticide Manual, 15th Edition, & unpublished study data*).

Insecticide	**Chemical group**	**Oral LD_{50} nanogram/bee**	**Contact LD_{50} nanogram/bee**
Deltamethrin	Pyrethroid	79	51
Alpha-cypermethrin	Pyrethroid	59	33
Chlorpyrifos	Organophosphate	360	70
Dimethoate	Organophosphate	150	120
Acetamiprid	CNI	14,500	8,100
Clothianidin	CNI	3.8	44
Imidacloprid	CNI	3.7	18
Thiamethoxam	CNI	5	24
Thiacloprid	CNI	17,320	38,830

The information listed in Table 1 shows that not all CNIs have significant hazard potential to honey bees due to substantial differences in their respective oral and contact toxicity to bees. It is thus scientifically questionable whether CNIs as a group pose a toxicological threat to bees. Some molecules are more toxic to bees than others, but it depends on how these molecules are applied as agricultural remedies whether the toxicity will materialise in bee mortality. Acetamiprid and thiacloprid (the cyano-substituted CNIs) are orders of magnitude less toxic to bees than the nitro-substituted CDIs namely thiamethoxam, clothianidin and imidacloprid due to rapid metabolism of these compounds by enzymatic action of the bee. Thiacloprid, for example, is applied in Germany year after year to flowering oilseed rape (a highly attractive crop for bees) during bee flight on more than 1 million hectares without causing any damage to exposed bee colonies. Due to this evidence and others, thiacloprid and acetamiprid can therefore be considered to be non-threatening to bees and will thus not form part of the rest of the discussion.

Furthermore, when comparing the toxicity of the more toxic (to bees) CNIs to commonly used pyrethroid and many organophosphate insecticides, it is clear that neonicotinoids are intrinsically not more toxic than other commonly used insecticides. Table 1 illustrates for instance that commonly used pyrethroid and organophosphate insecticides are not less toxic to bees than CNIs. Arguably, CNIs are systemic but so are some of the organophosphate insecticides. Moreover, systemicity only describes the potential of a pesticide to translocate within a treated crop, but says nothing about its toxicity to bees – a compound is not more toxic to bees simply because it is systemic. Generally, making statements about CNIs without putting into context of other pesticides is poor science. Bees are exposed to a large number of potential stressors of which pesticides are only one of many. Pesticides include a number of different chemical classes, including so-called “beneficial” pathogens and “organic” insecticides, none of which have been verified as non-threatening to bees despite claims of being environmentally friendly.

It must be clearly stressed that in the words of Paracelsus, the first recognised toxicologist, *“all substances are poisons, there is none that is not a poison. The right dose differentiates a poison from a remedy”*. Adding to this statement, for a product to pose any risk, its intrinsic toxicity and exposure to the organism in question, are both decisive. This means that even when a compound is intrinsically highly toxic, it poses no risk when the organisms under consideration are not exposed or exposed only to very small quantities of the compound. As we will outline below, this is the case for the neonicotinoids and bees.

CLSA therefore believes that CNIs, when applied according to label instructions including recommended safety measures, cannot be labelled generally as threatening to bees. No data has been generated through unbiased scientific research nor incidentally to substantiate the hypothesis that correctly applied CNIs have an impact on bee health in South Africa or elsewhere: globally there is not a single study existing that has shown adverse effects to honeybees at colony level caused by correctly applied neonicotinoid seed treatment products under realistic field conditions. Potential hazard posed by spray applications can be easily mitigated by appropriate safety measures, as demonstrated for instance in Europe, where incidents caused by such applications is very low. If there is a general concern about potential pesticide impact on bees then all pesticides should be equally reviewed and scientific studies should be conducted according to appropriate scientific design to test the hypothesis.

a. Studies on crops in which CNIs are applied as seed dressings have shown that some of these crops may have traces of CNI residues in nectar and pollen. However, as has been shown by dozens of residue studies in which hundreds of nectar, pollen, and blossom samples were taken and analysed, nectar and pollen residues resulting from seed treatment are invariably very low, typically between 0 and 5 parts per billion, which is far below the field NOEC of these substances for bee colonies (for imidacloprid and clothianidin, NOECs of 20 ppb have been established). These studies have been conducted in different parts of the world under different agricultural and climatic conditions. As residue concentrations found are consistently in the

same level, it can be considered as given that there are no significant differences in exposure under different regional circumstances. Thus, the available residue data can readily be used to assess potential risks of product uses in South Africa, although there are no studies available that have been conducted in South Africa. Residues in blossoms originating from drench treatments are more variable, depending of application timing, applied dose, and treated crop species. Here, potential exposure of bees needs to be evaluated on a case-by-case basis. Spray treatment of intrinsically bee-toxic neonicotinoids should not be done in bee-attractive crops during or shortly before flowering. If this safety measure is respected, there will be no exposure of bees: to understand this, it needs to be pointed out that neonicotinoids can only be translocated between different plant organs when they are applied to the roots of a plant, e.g. by seed treatment or drench application, as they can only move acropetally in the xylem, but not in the phloem. That means that the substances can, after being sprayed to a plant before flowering, not be translocated from the leaves to the blossoms.

b. The presence of a CNI in pollen and nectar does not mean that it is at a level where it will have an effect on bees. Finally, it needs to be taken into consideration that not all crops are attractive to bees and are thus visited by them to forage. Treatment of such crops with CNIs do *a priori* not entail any exposure to bees through nectar or pollen residues.

   CLSA therefore states that the CNI residue levels in pollen and nectar of seed treated crops are consistently below the toxic threshold for bees, as shown by in many global studies. In the case of drench and spray treatments, exposure can be effectively mitigated by appropriate application timing and other safety measures.

c. Studies conducted in South Africa on weeds that grow in between fruit trees revealed that no residues of CNIs that were applied to the fruit trees, were detected in the weeds' pollen and nectar. The assumption that weed pollen and nectar is contaminated with CNI residues does therefore not appear to be substantiated. No sensible farmer will in any case allow weed growth right at the trunk of a fruit tree were CNIs are applied as a soil drench. It is a serious water, nutrition, plant health and yield risk to fruit trees when weeds growth at the trunk. Furthermore, drench application should normally be done targeted to the trunk of the treated tree in order to ensure a maximum substance uptake by the tree and to avoid unnecessary loss of applied product to the soil. Therefore, it cannot be assumed that weeds that do not grow immediately next to the trunk may take up any residues of drench-applied neonicotinoids. In the case of spray treatments, a potential exposure can furthermore be mitigated by removal of flowering weeds before application

   CLSA therefore states that the probability of weed nectar and pollen being contaminated with CNI residues is so remote that it is not a factor to be considered. Nevertheless, CLSA will encourage fruit producers through the agrochemical distributors and producer organisations to keep orchards free of weeds. CLSA is of the opinion that the greater majority of fruit farmers maintain this practice in any way as part of their agronomical practices and compliance with GlobalGAP standards. Finally, it should be emphasized that potential exposure to residues taken up by weeds in treated orchards is not a CNI-specific issue but applies in the same way to all products that are applied as spray or drench treatments.

d. The CNIs that are registered on fruit trees for foliar application on fruit trees must be applied only after petal drop - that means after bees have lost their foraging interest in orchards. The potential issue of exposure via flowering weeds in orchards has already been discussed in the previous paragraph. It is therefore incorrect to assume that such CNIs will have an impact on bees while or after they have been applied. Those CNIs that are registered for such foliar applications are applied after petal drop and no impact on bees is therefore expected. Cotton is the only crop in which a foliar application may threaten bees. CNIs are not used any longer for this application and therefore this threat no longer exists.

CLSA therefore states that the use of those CNIs that are registered on fruit trees for foliar application pose no threat to bees because their toxicity to bees is not at the level where it will affect bees. These CNIs are applied after petal drop. Registration holders of CNIs that are still registered on cotton agreed to remove the cotton application from their labels at the next round of registration renewals.

e. CNIs are applied as seed dressings in a number of crops. The problem of dust that may be generated while planting these crops has been addressed through collaboration between CLSA members and SANSOR members (South African National Seed Organisation). A guideline was developed to ensure that seed is treated with a polymer that not only binds the CNI to the seed surface but primarily binds the CNI in such a way that dust generation is eliminated. CLSA and SANSOR members hardly ever sell CNI seed dressing products directly to producers; it is mostly applied either by seed companies or registration holders or their appointed distributors under strictly controlled conditions to ensure adherence to the guideline.

CLSA therefore states that dusting problems with CNIs have been appropriately addressed and leaves no reason for concern.

f. CLSA is aware of allegations that CNIs are applied through aerial application by individual producers. None of the CNIs are registered for aerial application. It can have a serious impact on honey bees that may be foraging close to these application areas or on hives close to such orchards. This is serious matter and a direct breach of the articles and regulations of Act No. 36 of 1947 as well as the SANS 10118 Aerial Application Standard. It is, however, something that the registration holders cannot foresee or control. Contravening Act No. 36 of 1947 is a matter for the Inspectorate of Act No. 36 of 1947 to address.

CLSA acknowledges that individual producers and individual aerial applicators do contravene the Act by applying CNIs through aerial application. CLSA commits itself to investigate such allegations and report incidents of this nature to the Inspectorate of Act No. 36 of 1947. The organisation will also do public awareness through the agricultural media to inform producers and aerial applicators of the industry's intention to report misconduct to the authorities. Registration holders inform their distributors not to contravene Act No. 36 of 1947 by recommending (advertising in terms of the Act) or selling CNIs for purposes or application manners other than those indicated on their labels. It should be emphasised that this kind of off-label use is not a CNI-specific issue, but applies in the same way to all products that are applied as spray treatments.

g. CLSA is aware of individual producers who apply CNIs on crops that they are not registered for, especially foliar application on vegetable crops. We are also aware that some agrochemical agents advise farmers to do so and sell CNIs for such applications. This is believed to not only be a major transgression of Act No. 36 of 1947 but also a threat to bees and other pollinators. As with the illegal aerial application of CNIs, CLSA cannot foresee or control this as it is a matter of law enforcement.

CLSA acknowledges that CNIs are sold and applied off-label and commits itself to investigate any such reported incidents and lay formal charges against offenders with the Inspectorate of Act No. 36 of 1947. The organisation will also do public awareness through the agricultural media and its own internal communication channels to inform agrochemical agents of the industry's intention to report misconduct to the authorities. Agents in the employment of CLSA members who commit these offences will be disciplined according to the CLSA Code of Conduct (this Code of Conduct ascribes to the FAO Code of Conduct). Producers that contravene the Act will be reported to the Inspectorate of Act No. 36 of 1947. It should be emphasized that this kind of off-label

use is not a CNI-specific issue but applies in the same way to all products that are applied as spray or drench treatments.

4. **Further matters arising from the CNIs versus bees debate: other factors to consider.**

    a. Extermination of bees in urban areas. CLSA produced a report in 2012 (CLSA Bee Management Manifesto) on the bee issue in urban areas. We believe that it is serious enough to warrant immediate action on the part of the pest control industry, the beekeeping industry and the state. The South African Pest Control Association (SAPCA) took the initiative based in the manifesto to start a process of regulating bee management. It seems to lack consistency that on one hand bee colonies are under certain circumstances eradicated with official authorisation, but on the other hand it is taken into consideration to ban agricultural crop protection products that are even just under the suspect to harm bees, which has not been proven by scientific studies under realistic conditions.

    b. Pathogens and parasites. Many scientific papers published in recent times have identified parasites and harmful pathogens as having a significant impact on bees. There is consensus among serious researchers globally that pathogens and diseases are the key factors threatening bee health and that they are the main cause of bee colony mortality. There are extensive monitoring results available from many countries that show that colony losses are nowhere correlated with the use of neonicotinoids, but that there are clear correlations between colony mortality and the occurrence with parasites and diseases. These surely have nothing to do with CNIs, yet the focus remains on CNIs.

    c. Poor beekeeping practices. CLSA will refrain from entering this debate but in the words of beekeepers themselves, there are many issues that need to be addressed at high level:

        i. Moving bees that are contaminated with pathogens and parasites. This is of major concern as it spreads pathogens and parasites into areas where bees were not exposed to these harmful organisms.

        ii. Using pesticides to control insect pests and parasites. Ants that plague beehives are often controlled with insecticides without taking into account that those products are *de facto* lethal to bees. Parasitic mites are also controlled with miticides and sometimes with insecticides that are not registered for such applications – it begs for an indication on how many colonies are exterminated by the irresponsible application of these pesticides.

    d. Uncoordinated pollination services. Beekeepers are very important service providers to especially fruit producers in supplying bees for pollination. Yet, there are regular incidents were poor or no communication between the beekeeper and the producer results in bee hives being left in or around orchards when bee-toxic pesticides are applied. This results in extermination of many hundreds of bee colonies. Irrespective of which pesticides are applied, it remains an issue that needs to be resolved between beekeepers and producers.

    e. Food shortage and imbalanced diets. It has been tabled and discussed at conferences that bees suffer from nutrition disorders brought on by a lack of sufficient food supply and imbalanced mineral and vitamin intake as a result of feeding on monoclonal crops.

This is a serious predicament for bees and has nothing to do with pesticides, especially not with CNIs.

f. Loss of foraging habitats. South Africa is losing natural habitat at an alarming rate – no one knows what the impact of this is on bees. Secondly, bees' main feeding habitat apart from agricultural crops, consists of Eucalyptus trees that are removed at a rapid rate under the Working for Water programme and thus foraging habitat is directly affected. What is a fact is that the number of calls to the Griffon Poison Information Centre's 24 hour helpline for assistance with bees that invade urban gardens and home, increased significantly over the past five years. It is an indication that something in the ecosystem is changing, forcing bees to move into urban areas. This has nothing to do with CNIs.

g. Organic farming practices. This is something that may develop into a highly controversial debate not because of the principles of organic farming, but because of some of the so-called organic, natural and biological agricultural remedies used in organic farming. CLSA has sound evidence that some of these products contain chemical constituents that are lethal to bees, and yet they are applied as if they are environmentally friendly. Some of the beneficial pathogens that are applied as pesticides are also of questionable quality. One can imagine the mass impact of such poor quality (and highly toxic) materials on bees and other beneficial insects.

5. **Summary.** CLSA remains committed to responsible and ethical production, sales and use of all agricultural remedies. When products come under pressure such as the case is with the CNIs, CLSA is prepared to take a critical look at the issues and address it appropriately if necessary. With this position statement CLSA has made commitments to address the issues that we believe are real issues, but the industry cannot take action on unfounded allegations. A number of reports and papers have most recently put the debate into a different perspective where the negative perception about CNIs is seriously questioned. CLSA believes that most of the actions against CNIs are the result of anti-pesticide lobbying that is based on highly questionable and untested hypothesis and research.