Consolidated Responses for the PAFPNet Discussion for the month of September:
Date: 22/09/14 – 6/10/14

The management of pesticides in the Pacific Islands Agriculture Production

The PAFPNet discussion for the month of September raised a number of issues as well as suggested solutions. During the discussion, the use of chemical pesticides was seen in the light of two scopes, highlighting both the beneficial aspects of its usage as well as its harmful effects.

Although it was agreed that the use of pesticides does definitely contribute towards enhancing agricultural growth, the effects that follow is the issue. In stating this, majority of the members placed emphasis on the importance of understanding the use of pesticides and following the required protocols in its usage. In having a clearer understanding of its use, the side effects of the chemical would be reduced drastically.

The use of pesticides is a concept that is impossible to completely move away from and is seen as a necessary evil, meaning that the need for the use of pesticides is fundamental for sustaining agriculture.

Majority of the respondents have stated that the use of chemical pesticides unnecessarily can and should be done away with. It was mentioned that the best solution to minimizing the effects and toxicity of pesticide use would be to simply ban it altogether. In reference to the members' responses there have been steps undertaken which has already been either considered or initiated by their countries as the result of the detrimental effects pesticide use has on their water supply and human health.

From experience the wise use of pesticides has been identified as an area lacking focus. This discussion provided a platform for all the members to share on common grounds that Personal Protective Equipment (PPEs) is rarely used when dealing with pesticides. Bad practices are simply due to high cost of PPEs as well as the humid weather conditions. Also most of the Pacific Island Countries and Territories (PICTs) lack this personal protective equipment (PPEs) and the knowledge to understand the behaviour of each individual pesticide. This lack of knowledge triggers the mismanagement use of pesticide.

The implementation of pesticide legislation and registration is very important as stressed by the members. Imposing these regulations will improve pesticide monitoring in to countries and provide a clearer understanding of the behaviour of each individual pesticide.
The members also suggested that Integrates Pesticide Management (IPM) approach can be an alternative to the use of chemical pesticides. IPM generally includes the agricultural use of biological controls, cultural methods, pest monitoring, crop rotation, the use of botanical pesticides and composting.

Many of the members have seen the need for a shift towards using organic pesticides. Although, chemical pesticide use is a means for keeping production at its peak it was pointed out that consumers are also making a shift towards the consumption of organic agriculture produce. The discussion did not fail to highlight the high labour intensive work involved in organic farming, but it also did not forget to illustrate the long-term benefits of this practice. Organic farming according to the members will not only improve the soil content and safeguard drinking water supplies but also protect human health for both farmers and consumers.

The assessments of the consolidated responses were gauged from the questions below:

1. What are your views on use of chemical pesticides for agriculture development,

2. In general are farmers using pesticides wisely in relation to proper protective clothing (if not, what are the reasons for not using safety clothing), correct measurements of pesticides, using the recommended pesticide for a particular pest/disease (substituting a different pesticide), proper spraying times, storage, and proper disposal of pesticides (and empty containers)

3. Use of alternatives to pesticides (resistant varieties, improving soil health techniques, organic agriculture, crop rotation, mulching, trap crops, mixed cropping)

Please visit the following link PAFPNet discussion: http://www.spc.int/lrd/pafnet-publications/cat_view/137-all/136-pafpnet/491-discussion-queries

Responses from:

1. **Mr. Fereti Atumurirava, Secretariat of the Pacific Community (SPC), Fiji**
2. **Mr. Emil Adams, Secretariat of the Pacific Community (SPC), Fiji**
3. **Mr. John Ericho, Conservation Forum of Papua New Guinea**
4. **Mr. Josua Wainiqolo, Secretariat of the Pacific Community (SPC), Fiji**
5. **Mr. Poimatagi Okesene, Department of Agriculture, Forestry and Fisheries, Niue**
6. **Dr. Shane Tutua, Commercial Organic Farmer, Solomon Islands**
7. **Ms. Lusiana Ralogaivau, South Pacific Regional Environment Programme (SPREP), Samoa**
8. **Ms. Teaaro Otiuea, Department of Agriculture and Livestock, MELAD, Kiribati**
9. **Mr. Tamdad Sulog, Department of Resources and Development, Federated States of Micronesia**
10. **Dr. Siua, Secretariat of the Pacific Community, Fiji**

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1. **Mr. Fereti Atumurirava, Secretariat of the Pacific Community (SPC), Fiji**

The usage of chemical pesticides is something that is impossible to completely move away from. Even in the context of organic farming, chemical pesticides are still being used. However, the pesticides that are being used in the organic produce are being mild in nature and non-hazardous. On another note, with the shift away from chemical pesticides being impractical, the move from **Hazardous** chemical pesticides has been seen as a more achievable option. I would suggest that there be more emphasis placed on strengthening the registration and legislation process for pesticides in the country. This process will provide more awareness on the compatible pesticides available and the right type of pesticides to use. This process will definitely help reduce the reliance on hazardous chemical pesticides which will help safeguard the agricultural environment as well as human health.

In recent years, it has been identified that farmers are not using the complete protective gear/clothing required. Most farmers choose to wear their masks and gloves and disregard the need to wear their overalls/coats. The reason for this includes:

- They find the protective clothing uncomfortable due to the hot weather conditions
- The cost of the protective clothing exceeds most of these small holder farmers budget

Moreover, many farmers do not realize that the various pesticides they use all have different significant effects on human health in both the short and long-term. For instance, farmers seem to overlook the concept that insecticides and herbicides have two totally different effects, with insecticides being milder than herbicides (eg. Paraquat). Therefore, farmers tend to neglect the need to wear more precautionary protective equipment when dealing with herbicides thinking the mild effects from using the insecticides still apply.

Moreover, in relation to the use of pesticides, there is no proper resistant management strategy. Farmers are always in to receive the highest return from their produce in a short time frame; therefore the strategy of using one product at a time does not work. Farmers tend to use the same chemical pesticide over the required period of time which results in insect pests forming a counter mechanism or resistance to the pesticide being used. This results in the misuse of pesticides by farmers increasing the chemical dosage, the frequency of spraying and the time duration of the pesticides. This mismanagement of the use of pesticides is harmful because it affects the non-target organisms, human health and the bio-diversity in the long-run.

In reality, there are no good alternatives for pesticides. However, the best approach to this issue would be through the Integrated Pesticide Management approach (IPM). This approach looks at various methods for pesticide use either biologically, physically, culturally and as a last resort, chemically (as long as it is compatible). Moreover, a few examples of alternatives under the IPM would include:

- The use of compatible insecticides
- Plant derived pesticides
- Bacillus thuringiensis (Bt)

Moreover, in relation to the plant derived pesticides, for some areas, it is best to steer away from this approach if it poses to be a negative factor toward food security. For instance, if chilli or garlic spray were to be used, it must be kept to a minimum and of last resort.

2. Mr. Emil Adams, Secretariat of the Pacific Community (SPC), Fiji

Pesticides are a necessary evil; farmers need them to help cope with pests and weeds so there are good yields from farms; otherwise pests run wild eating up crops with no yields, no food to eat and no income. There really should be nothing wrong with pesticides, as long as farmers abide by the instructions on the label in correct mixing rates, wear appropriate clothing for their safety, use the correct pesticide to treat the right pest, spray at appropriate intervals and away from water systems such as rivers and lakes, allow for the required waiting period before harvesting, and have proper storage facilities on farm for safety storage of pesticides. Farmers should also know that after using a pesticide over many crop seasons, the insects will develop a strong resistant to that pesticide. Thus, they should rotate the use of pesticides.

Labour is a big cost factor in agriculture production, thus pesticides help to reduce labour costs especially for weed control.

Govts should have in place proper policies and legislation to regulate the import, distribution and safe disposal of pesticides. Govt needs to put in place proper awareness on pesticides so farmers are aware of the negative effects of miss use of pesticides as well the general public is empowered with this knowledge and make wise decisions about pesticides in produce. Govt really should be more pro-active in pesticide monitoring, not allowing anyone to import any pesticide they want.

Govt through DAFF should actively promote the use of alternatives to pesticides and help change farmer mindset from always thinking about pesticides to fix a pest to non-chemical control measures such as resistant varieties, use of natural enemies or biocontrol, use of plant-based treatments such as chillie spray, use of mixed cropping and crop rotation, practice organic agriculture, use of cover crop to suppress weeds such as mucuna, crop rotation, etc. DAFF needs to constantly conduct training plus awareness to show farmers these alternatives to pesticides. They need to stress in the messages that these alternatives may not kill all the pests but helps maintain the health of the environment for their children.

Pesticides are necessary, just need strong govt policies to regulate their use and management, strong policies and subsidies to promote the use of alternatives, and continuous education to farmers and general public about pesticides and their effect on humans and environment.

3. **Mr. John Ericho, Conservation Forum of Papua New Guinea**

The world is overloaded with chemicals in all the factory made foodstuff that we stuff ourselves with everyday day.
One may pick a food packaging cover and read all the additives that go into the food that we eat and will be surprised how our liver can manage that. Not satisfied with that we are going into GMOs and further we are fertilizing with growth hormones in our food in the gardens in haste to produce large quantities in a short time possible to feed the many mouths that the world is adding everyday. Now we are protecting our food supply with these pesticides that as we know while they do the intended job they do collateral damage to our food chain and eventually reach us bringing health and ecological damage to the top carnivore -man.
Surely we all know the planet can only support so much and may have reached that capacity (carrying capacity) long time ago (we are propping it with chemicals like fertilizers and pesticides etc).So how long can that propped up system go on in the face of climate change? We maybe up for the next ecological collapse soon...?

I think we in the PIC should promote :
1. Composting
2. time for soil to recover
3. Population planning
4. Organic foods
5. slow or nil on chemicals(fertilizers and pesticides)

Fertilizers, pesticides and additives are not about human or ecological health it is all about economics.

4. **Mr. Josua Wainiqolo, Secretariat of the Pacific Community (SPC), Fiji**

In the PICTs the use of chemical pesticides is a quick fix to control an incursion of pests or invasive alien species. Although most are unaware of side effects if not use correctly. There are still farmers who don't use the protective clothing when using these toxic chemicals. To them its uncomfortable given the humid conditions that they work in the fields. I feel that people take things for granted and hope that all is ok. There needs to be a strong advocate when these pesticides are sold to the farmers by the suppliers on the correct use and the side effects it has on human health and our fragile environment.

There are alternatives that SPC team have been involved in i.e. the use of cover crops such as Mukuna before planting, crop rotation etc.

5. **Mr. Poimatagi Okesene, Department of Agriculture, Forestry and Fisheries, Niue**

Chemical pesticides should be managed properly and in a sustainable manner. Firstly the chemicals should be understood fully (its purpose, proper use and toxicity levels, harmful effects to humans and environment) by the users or farmers in using for agriculture development. Failing to understand the purpose of each chemical pesticide will eventually lead to chemical misuse and utilizing it for wrong purposes that will affect or have negative impacts on human health and environment.

Additionally, chemical pesticides were developed to assist with enhancing level of production of crops, animals etc.. in Agriculture Development and should contribute minimal harmful effects to users and environment. In the context of Agriculture development in Niue, farmers rely heavily on chemical pesticides to control insects and weeds. The uses of these chemicals eases the burden on farmers with having to manually control weeds such as "pulling" which is very labour intensive. 80% of the population in Niue are farmers including part-time farmers and are highly involved with other community commitments that time allocated to farming is affected by these commitments. Hence farmers rely heavily on a simple method to control weeds and insects that takes up minimal time and effort.

Moreover, with Niue having a small population, education and awareness would play a fundamental role in educating people with proper use of chemical pesticides and the use of proper protective gear. Farmers and all chemical pesticide users need to be properly educated in all aspects of understanding the chemicals, toxicity levels, harmful effects, proper uses and disposal methods.

Majority of farmers in Niue are not using proper measurements and correct required doses of chemical pesticides and the use of proper protective gear. Majority of the farmers not using proper protective gear is due to high added costs and the lack of understanding of risks and toxic harmful effects on human health and environment. Some users are aware of these risks and harmful effects but sometimes its pure negligence and also being careless.

Paraquat is one particular pesticide(herbicide)that is widely used in Niue by all farmers in controlling weeds. It is regarded as highly toxic under the WHO list of Highly Hazardous Pesticides and we have yet to find a very effective and affordable alternative that is less toxic than paraquat. Prolonged use of paraquat may also lead to underground water contamination which is a very valuable resource for all Niueans as drinking water.

Furthermore, the use of alternative methods to chemical pesticides is very much a priority of the Department of Agriculture, Forestry and Fisheries and with the backing of Niue Government in promoting organic farming principles. The Agriculture Department is currently promoting composting and mulching farming techniques in support on the Niue Organic Farmers Association(NIOFA) mandate. Several farmers are currently practicing these organic farming principles but it seems to be very time consuming and highly labour intensive. The promotion of organic farming principles continue to be on going as environmentally friendly farming methods and no exposure of humans to risks and highly hazardous pesticide chemicals.

6. **Dr. Shane Tutua, Commercial Organic Farmer, Solomon Islands**

As an organic farmer, and working with organic farmers here in Solomon Islands, I am becoming more and more convinced that chemical pesticides are unnecessary, and at most should be the last of the last resorts. For 20 years we have been operating an organic market gardening Honiara, Solomon Islands, and we haven't used a single chemical pesticide, and yet we can still operate a profitable business. It does not mean that we don't have pests and we don't have some crop losses through pest attacks, rather we minimised their impacts through our organic farming practices.

Additionally, in relation to using pesticides wisely, this is not practiced in the Solomon Islands. Many farmers can't afford protective clothing, don't have measuring equipment to apply the right dosage, don't understand the need for proper storage and disposal. And are not complying to withholding periods.

On the same note, the use of alternatives should be encouraged for adoption by farmers. We have been using most of the technologies listed here on our farm, and it probably explains why we had low intensity pest attacks mentioned in (1) above.

7. **Ms. Lusiana Ralogaivau, South Pacific Regional Environment Programme (SPREP), Samoa**

Workshop last week was very enlightening and look forward to working more closely with the Agriculture sector of PICs and the SPC and FAO, in addressing associated hazardous waste matters.

Regarding the questions you forwarded, I do share the same sentiments as those that have highlighted the many issues arising from pesticide use. I have also added some thoughts below, and also sharing some highlights on the GEFPAS POPs release reduction project for PICs.

Pesticides are toxic, not only to the environment, but also sadly to human health, and this is a growing concern for Pacific Island Countries. Few issues that need highlighting on the use of pesticides are as follows:

- Soil Contamination is certainly an issue of concern, especially for PICs, considering our already limited land availability, limited water resources, fragile ecosystems, increasing population pressures, and limited buffering capacities. The GEFPAS is looking into further assessments of some countries in PICs to confirm contamination level.
- Where does all the empty pesticide container end up? These empty pesticide containers are posing a significant contamination risk - they are most commonly used to store drinking water in many PICs, which is certainly a health hazard. If not in use, the other problem is that they are left unattended and merely take up space. The GEFPAS project will be looking at setting up stewardship systems for PICs - in helping address this issue, where the decontamination process will be one of the highlights, and possibly a model set-up of an Extended Producer Responsibility System.
- An issue of concern highlighted under the GEFPAS POPs Release Reduction Project, is how the adverse impacts of the use of pesticides affects the financially disadvantaged (specifically women and children) .In agricultural communities where agriculture is a key economic activity, women are more likely to be indirectly exposed during planting and harvesting, as pesticides are usually left stored in the house. Women are usually tasked to do domestic duties in the house, and by remaining a long time in house , women are more exposed to those chemicals. The GEFPAS project will be undertaking trainings in 14 PICs on the proper handling and storage of chemicals, including pesticides, and should certainly help countries, especially the agriculture sector understand the implications of exposure to such toxic substances.

The toxicity of such is beyond any natural remedy to minimize its effects, hence one of the best solutions is simply banning, and this is where the aligned conventions come in.

In addition, from what has been gathered, there is little, to no protective gear available in majority PICs, nor are they made to be compulsory, considering the associated health implications. The unavailability could be due to limited knowledge on the implications of not wearing protective gear when in contact (at both local and national government), the un-affordability of such PPEs by countries, or simply not having such policies in such working environment.

In regards to the use of alternative pesticides, this is something that is greatly needed, that is the reduced reliance on hazardous pesticides through the promotion of less toxic pesticides or the total banning where possible. This is something that would need both national, regional and international partnerships, with the intensive promotion of alternatives made. A way forward as a start for PICs, is to collectively work together in the ratification of the all aligned conventions (Rotterdam, Basel, Waigani and Stockholm) by all countries, especially the hub of the Pacific (Fiji), not to allow any movement of such within the region. Concurrently, ensuring these alternatives are adopted at local, and national level,with thorough awareness would certainly take this to another level of assurance, both environmental and health wise.

8. **Ms. Teaaro Otiuea, Department of Agriculture and Livestock, MELAD, Kiribati**

This is the view of Kiribati in relation to the use of chemical pesticide.

The use of chemical pesticide is generally preferred worldwide for the purpose of increasing crop yield in order to feed the increasing population of the world as well as to gain profit and of course wealth. In the Pacific region, some countries are using chemical pesticides for certain reasons especially to reduce the damage to crops by pests. In Kiribati, the Agriculture & Livestock Division has stopped using chemical pesticides due to the fact that we could consume it through our only source of drinking water which is the underground water lens. Given that our soil is composed mostly of sand, it is therefore porous and hence allow leaching of chemicals through and finally reach our drinking water source.

Growers are encouraged to use alternative methods of reducing pests damage as well as using other cropping practices. Some examples are the use of biological control agents, crop rotation, the use of botanical pesticides, etc. However, with the lack of legislation to control the entry of chemical pesticides, I believe that there are still pesticides being used in Kiribati that are beyond our knowledge at the Agriculture & Livestock Division.

I am personally grateful to be able to attend the recent workshop on the Rotterdam Convention held in Suva because this is where I am fully aware of the benefits of this Convention to the countries ratifying the convention. In my opinion, Kiribati should be one of the countries to ratify this convention soon given it has a very fragile environment and a strong support for organic agriculture.

Thank you again Brittany for this opportunity to share the view of Kiribati.

9. **Mr. Tamdad Sulog, Department of Resources and Development, Federated States of Micronesia**

Recognizing the critical importance of our traditional farming technology which has sustained us for hundreds of years, and our department mandates to promote environmentally sound production systems, there is no demand/ or needs of pesticides when it comes to promoting agriculture development, especially in small Pacific Island Countries. Traditional farming methods and

technology for growing local crops blend well with the environment that even a small plot of land can yield crops all year long for a typical family in Yap. With this in mind, including the high costs and risks associated with pesticides, our department made a policy decision several years ago to refrain from using pesticides or commercial fertilizer. This decision to restrict the use of chemicals and pesticides was also based in part to mistakes made in the 70's and 80's when so many types of chemicals and pesticides were purchased and stockpiled by the government in the pursuit of speedy development, especially agriculture development. The negative impact and damage to the environment from these chemicals is only becoming more obvious today based on recent studies and analysis. No conclusive studies to date have been conducted on the health of the people most likely to also have been affected however; one can only conclude that if we are part of the environment, then the negative impact would be similar.

At present there are about half a dozen commercial farms on Yap, all managed and run by foreigners mostly focused on growing fruits and vegetables (introduced). Initially, most of these farms had to use chemicals and pesticides to keep production at optimum level and of course to make a profit. However, the majority of these farms are now gradually shifting to organic farming. Why? Because, the consumers and buyers are also catching up- "use chemicals/pesticides, and we won't buy." This is true at most retail outlets and supermarkets where locally grown fruits and vegetables sell faster than the imported ones even though the prices of the latter are much cheaper. Certainly, an effective public health awareness campaign several years in the making is finally producing desirable results.

The only agriculture activity which we have to resort to the use of chemicals (herbicide) is invasive species eradication and control. This is because the risks of new alien invasive species, especially the most dangerous ones far outweigh the risks of chemicals and pesticides used in agriculture, in terms of costs and damage to crops, the environment, and livelihood of the people. We tried our best and whenever feasible, use alternate biological agents in our on-going efforts to control certain invasive species.

In conclusion, most if not all farmers in Yap and Micronesia does not use chemicals and pesticides on their farms. Introduced crops and vegetables which often attract pests and diseases can thrive when integrated and grown alongside local crops in traditional farm settings. Sure, sometimes there are outbreaks of certain pests and diseases which can be alarming to most farmers thus the high demands and requests for pesticides during these periods. But these pest outbreaks, often the result of damaging storms or climate change usually subside and return back to their dormant stage.

10. Dr. Siua, Secretariat of the Pacific Community, Fiji

I have been reading the interesting discussions and cannot wait but to throw in my 20 cents contribution.
When we are dealing with pesticide use there certain properties of the pesticides that we should look at to guide their uses and may be their registration.

1. Loss Pathways
Pesticides can reach surface and ground water through runoff and leaching.
Occurrence of pesticides residues in edible parts of plants is significant in human exposure.
While pesticides released to the atmosphere have an impact on air quality and may create problems when agricultural workers enter the treated areas.
To understand how pesticides behave as mentioned above it is necessary to know how pesticides behave in soil and water.

Once applied to cropland, a number of things may happen to a pesticide. It may be taken up by plants or ingested by animals, insects, worms, or microorganisms in the soil. It may move downward in the soil and either adheres to particles or dissolve. The pesticide may vaporize and enter the atmosphere, or break down via microbial and chemical pathways into other, less toxic compounds. Pesticides may be leached out of the root zone by rain or irrigation water, or wash off the surface of land. The fate of a pesticide applied to soil depends largely on two of its properties: persistence and solubility.

2. Persisitence

Persisitence defines the power of a pesticide to last in the environment. Pesticides degrade over time as a result of may be chemical and/or microbiological reactions in soils. Sunlight can also break downs chemicals. Chemical pathways mostly result in only partial deactivation of pesticides, whereas soil microorganisms can completely break down many pesticides to carbon dioxide, water and other inorganic constituents. Some pesticides produce intermediate substances as they degrade. The biological activity of these substances may also have environmental significance. Because populations of microbes decrease rapidly below the root zone, pesticides leached beyond this depth are less likely to be degraded. However, some pesticides will continue to degrade by chemical reactions after they have left the root zone.

Persistence is measured in "half-life." Each half-life unit measures the amount of time it takes for one-half the original amount of a pesticide in soil to be deactivated. Half-life is sometimes defined as the time required for half the amount of applied pesticide to be completely degraded and released as carbon dioxide. Malation is non-persistent with half-life < 30days; Glyphosate is moderately persisitent >30days but <100days; and Paraquat > 100days. When we spray within this half-life we build up chemicals in the soil - hence we can poison our soils.

3. Solubility and Sorption

Probably the single most important property influencing a pesticide's movement with water is its solubility. Soil is a complex mixture of solids, liquids and gases that provides the life support system for roots of growing plants and microorganisms such as bacteria. When a pesticide enters soil, some of it will stick to soil particles, particularly organic matter, through a process called adsorption and some will dissolve and mix with the water between soil particles, called "soil-water." As more water enters the soil through rain or irrigation, the adsorbed pesticide molecules may be detached from soil particles through a process called desorption. The solubility of a pesticide and its sorption on soil are inversely related; that is, increased solubility results in less sorption.

One of the most useful indices for quantifying pesticide adsorption on soils is the "partition coefficient" (PC). The PC value is defined as the ratio of pesticide concentration in the adsorbed-state (that is, bound to soil particles) and the solution-phase (that is, dissolved in the soil-water). Thus, for a given amount of pesticide applied, the smaller the PC value, the greater the concentration of pesticide in solution. Pesticides with small PC values are more likely to be leached compared to those with large PC values.

Carbofuran (trade name Furadan is a nematicide widely used on banana in the past) has PC of 29; Carbaryl has 229; and Malathion has 1,778. Do Furadan is more likely to laexch and Malathion to adsorb to the soil.

In evaluating the contamination potential of a particular pesticide, it is essential to consider its partition coefficient and half-life jointly. For example, a pesticide with a small PC, say less than 100, and a long half-life, say more than 100 days, poses considerable threat to ground water through leaching. On the other hand, a non-volatile pesticide with a large PC, say 1000 or more, and a long

half-life (e.g., more than 100 days) is likely to remain on or near the surface of soil, increasing its chances of being carried to a lake or stream in runoff. For pesticides with short half-lives, (less than 30 days), the possibility of surface or ground water pollution depends primarily on whether heavy rains or irrigations occur soon after application. Without water to move, pesticides with short half-lives remain in the biologically active root zone of soil and may degrade rapidly. In terms of water quality, pesticides with intermediate PCs and short half-lives may be considered "safest." They are not readily leached and degrade fairly rapidly.

Agricultural use of pesticides should be part of an overall pest management strategy which includes biological controls, cultural methods, pest monitoring and other applicable practices, referred to altogether as Integrated Pest Management or IPM or ICM. When a pesticide is needed its selection should be based on effectiveness, toxicity to non-target species, cost, and site characteristics, as well as its solubility and persistence.

Half-lives and partition coefficients are particularly important when the application site of a pesticide is near surface waters or is underlain with permeable subsoil and a shallow aquifer. Short half-lives and intermediate to large PC's are best in this situation.

Thank you and hope that this 20 cents will throw some light into the behaviour of pesticides and how we should select them. If we follow these we will lessen contamination of environment.