The philosophy of integrated pest management

Dr Gerhard H Verdoorn
Stewardship and Operations Manager, CropLife South Africa

To integrate or not integrate?
Integration means to assimilate or mix one entity into another so that the combined entities maintain their own identities but complement each other in all aspects. A good example of integrating is where a farmer is mixing an animal feed supplement into his animal feeds to bolster the nutrient value of the feed. It means he has to offer less animal feed to achieve the same growth objectives due to the added value of the feed supplement. In crop production it is globally accepted that pest management is required for healthy and productive crops, yet we cannot simply continue to apply synthetic chemical pesticides as the only tools for pest management. Integrated pest management (IPM) means adopting and implementing new tools into our pest management strategies. It is new, exciting and costs less than simply relying on classic pesticides.

What should be integrated?
Many people believe that integrated pest management means using different types of pesticides such as biologicals, natural and "organics" alongside synthetic pesticides, but that belief is far off the mark. IPM is a concept as wide as the universe that adopts a variety of tools to make pest management environmentally compatible, more effective, more cost effective and with due consideration of human health. The concepts that a modern farmer should incorporate are:

- Cultivation practices
- Adoption of resistant or adaptable cultivars
- Implementing scouting and early warning systems
- Implementing sanitising practices
- Adopting alternative pesticides meaning the natural and biological products
- Adopting natural predators
- Adopting soil improvement systems

Cultivation practices
In the "good old days" we ploughed and planted every year. It had its advantages such as burying insect eggs, larvae and weed seeds so deep underground that they all perished. Ploughing also added plant materials as compost to the soil but the greatest disadvantage of year-on-year ploughing was that it stimulated massive erosion due to breaking down soil particles. With the advent of minimum till and no till cultivation practices, the erosion problem has been virtually solved but it also brought some challenges namely

- insects such as stalk borers had no mechanical destruction imposed upon them,
- rodent such as the pesky gerbil is living undisturbed year after year,
- weed control demands more herbicide use,
- harmful pathogens are left on the soil in crop residues that warrants burning crop residues (carbon footprint!) and
- soil compaction is becoming an issue.

So, do till or don't we till? The smart thing to do in the IPM philosophy is to plough occasionally to a good depth to bury all the unwanted pests and pathogens. It may only be required once in a four year cultivation cycle and therefore we maintain the no till

cultivation practice but integrate one good ploughing exercise into our long term plans.

A fruit producer may require a totally different approach to cultivation practices than a cash crop farmer. Weeds growing in orchards are a real menace as they have the following impacts on trees

- they consume massive volume of water and nutrients,
- they often produce harmful toxins that impact on tree health,
- they harbour insect, nematode and mite pests,
- they are host to pathogens that cause plant diseases and
- they may even contaminate the valuable fruit with unacceptable weed fruits and seeds.

IPM for a fruit farmer thus requires a very good weed management programme that may mean mechanical slashing weeds or using a desiccant herbicide to control weeds.

Resistant And Adaptable Cultivars

Since the earliest times of agriculture farmers have been striving to cultivate better crops and mostly selected for higher yielding varieties. Sadly, this quest for better yields have had one huge negative result namely ending up with monocultures without resistance to pests, diseases and weeds and that are not adaptable to climate change. There is focal shift in the era of scientific agriculture namely to breed and cultivate varieties or cultivars that are adaptable to climate change and resistant to pests, diseases and weeds. Science brought us tools such as genetically modified crops that have special traits such as its own protection against insects, resistance against certain herbicides and of late, a possibility of drought resistance. Research institutes also hybridise cultivars with genetic modification to find adaptable cultivars especially in view of climate change. Cash crops with a shorter growth cycle are much sought after to combat late rains and shorter production season.

Scouting and early warning systems

Pest control with pesticides (synthetic natural and biological) is a costly exercise hence one would endeavour to dispense as little as possible of this in the production season. If a pest, disease or weeds is discovered when it is at the mature point in its life cycle, it demands a high load of harsh pesticides that will obviously increase production costs. Mature insect larvae are often very difficult to control while the younger instars are highly susceptible to insecticides. In the modern agricultural era, it is very important to use early warning systems for pests, diseases and weeds. A simple tool is to be fully informed of the weather conditions and a smartphone app such as Windy is essential for any farmer especially for forecasting disease outbreaks and pest infestations. Moist and hot conditions are conducive to pathogen sporulation and if a farmer can predict this by using a weather app, then the problem can be treated prophylactically.

Insects are wonderful in the sense that chemical communication plays a vital role in their biology. Entomologists exploit this by synthetically producing pheromones such as the female sex pheromones of many pest species and using it to attract males to pitfall traps. A few such traps and pheromone lures in a huge crop field are invaluable to gauge the prevalence of pest species. A sudden increase in male moths spells a possible infestation and the farmer can prepare to control the infestation at low costs in the very early stages.

Visual inspection of crops is still a valid tool to determine if a pest has established itself. Egg parcels, shot holes in leaves, flower bud damage and clouds of moths late afternoon means there is a need to implement pest control!

Sanitising practices

Sanitising is particularly useful in disease control namely fighting plant pathogens (harmful fungi). If a plant disease is discovered in the early stages of infection it may be worthwhile to prune those plant parts out and burn in a hot fire to destroy the pathogen. It may also require the application of a preventative fungicide that is often more effective and successful to control an infection than to eradicate it once it is established in a crop. Equipment often plays a vital role of disease proliferation and that demands proper sanitising of pruning shears and other equipment used in infected orchards. If a cash crop was infected with a pathogen it is worthwhile to burn the crop residue to

eradicate the pathogen as chemical treatment will have no effect and will be costly.

Alternative pesticides
The new generation natural and biological pesticides are exciting and offer farmers a totally new way of pest management. It does, however, need a paradigm shift as naturals and biologicals need a bit more effort to apply due to their climate sensitivity. Despite this is their substantial evidence that these products are very effective, yet soft on non-target species. Many farmers are already deploying Bacillus bacteria and Beauveria bassiana fungi as biological control agents, whilst many other biological pesticides and standing at door begging for attention. Natural insecticides such as azadirachtin from neem oil and oxymatrine are well established in the market. Such pesticides can often replace the older, harsh organophosphates at the same level of success. It is quite possible that pesticides will be at least 20% biological and natural in ten years' time. It is very interesting that many of the new biological compounds are harvested from natural soil and it means they are automatically compatible with the broader environment. Nature has a wealth of natural and biological pesticides awaiting discovery and exploitation.

One other use of pheromones is to disrupt mating; it is thus using a natural chemical to disrupt the mating behaviour of pest species and thereby preventing proliferation of the pest species.

Natural predators
Beneficial insects and nematodes are also starting to make their voices heard in pest management. Entomopathogenic nematodes are superbly geared towards pest control for some soil borne and normal plant borne pests. The good things are that by "inoculating" (it is more correct to say infesting) plants with these nematodes one establishes colonies that multiply themselves while making short work of pests. Some wasp species and ladybirds are also bred commercially as biological control systems.

Improving soil health
Healthy soil means healthy plants and using certain inoculants and natural chemical along with compost is known to beneficially improve soil health. It is a very new field viewed by many with scepticism but worthwhile to investigate.

Summary
It is every farmer's choice whether to go for IPM or not. The advantages of IPM outweigh the costs totally. Chemical pesticides are under pressure and it is inconceivable that we will have these products forever as the only tools for pest management. Start implementing IPM sooner than later and become part of the green revolution!

Contact the author: 082-446-8946

CropLife SOUTH AFRICA SUID-AFRIKA