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Chapter 1 : CURRICULUM DEVELOPMENT FOR PLANT PEST MANAGEMENT IN ASIA-PACIFIC

Integrated pest management in the Philippines. This chapter covers the history of integrated pest management (IPM), organizational structure of IPM, pesticide policy, IPM application in major crops (rice, maize and cabbage), impact of KASAKALIKASAN (an IPM programme with farmers as the main participants) on agricultural production, and.

The IPM trainers make a map of the area in which they plan to work. On this map, they identify where their office will be situated, outline the extension areas for which they are responsible, and identify the extension worker s responsible for each aspect of work. Each of these extension areas is then evaluated on the basis of a set of criteria. They also help to develop a curriculum and plan for FFS activities based on the local conditions and issues. Their support of the FFS will help eliminate any misunderstanding at the local level. Final selection of the participants is carried out with their help. Only 25â€"30 farmers may participate in the FFS. The following criteria are crucial for selection of FFS participants: The participant must be an active farmer. This means that the participant has access to land which he or she actively farms. Of lesser importance is the extent of the land being farmed or whether the land is actually owned by the participant; The participant must be able to attend all of the FFS sessions. These approaches and methodologies approximated the concept of pedagogy, which means the art and science of teaching children to learn Medina and Callo, Jr. It used the traditional lecture or didactic approach to learning. Attitudinal relationships in this approach were nearly always on the parent-child, teacher-pupil, professor-student, or guru-disciple level. It meant drawing conclusions from accepted or already known principles, concepts, generalizations, as well as theories, and to infer from them so as to expand the principles further. The main objective of learning was to increase or change the factual knowledge, with the hope that the latter will be applied to life. This was the chief extension strategy of the Philippine Masagana 99 Rice Production Program in the early s. Masagana 99, the green revolution for rice and the apparent forerunner of IPM in rice in the Philippines, advocated the use of short, early maturing, high yielding pest resistant varieties to complement pest-suppressing cultural and physical practices. The strategy also demanded an increase in use of fertilizers and pesticides; the latter as preventive measure by calendar applications that have resulted in more pest outbreaks and higher crop loss ultimately. Introducing farmers to IPM practices has proved to be difficult. Conventional extension methods that were classroom-based could not be adapted to the local conditions, allowing only one-way flow of information from extension agents to the farmers. The latter received the same pre-determined advice regardless of the diversity of the agroecological environment and the pest problems. Andragogical Early s to the present In contrast, the IPM training approaches or methodologies used in the late s are andragogical in nature. These approaches and methodologies approximate the concept of andragogy, which means the art and science of helping adults learn Medina and Callo, Jr. In the learning process, a set of individual cases or circumstances is presented for study. From their own empirical observations, participants formulate concepts, establish general principles, and perhaps evolve theories that will provide greater clarity to the understanding of these cases or circumstances. The learning process is evocative, dialogic, participatory and experiential. The andragogic approach to IPM extension education that was successfully piloted in was essentially discovery-based, experiential and participatory in nature and has the following features: Andragogy as a learning strategy uses mostly NFE methods and approaches. NFE methods and approaches, as knowledge management strategies, bring about sharing of knowledge and the creation of new knowledge, and in the process empowers the participants. Activities focus on allowing participants to observe, discuss, interact, brainstorm, as well as perform analysis, including making critical decisions and solve problems Callo, Jr. Essentially, NFE is a participatory educational process based on the assumptions that the adult learners can contribute to the learning process. When adult learners decide to participate in any learning activity, they bring along a wealth of experience, knowledge and skills. They are armed with their own beliefs, values, and convictions. They have their own perceptions, biases and feelings. With such a background, the adult learner is the richest resource in the learning process Ortigas, NFE methods and approaches encourage participants to see themselves as an important source of information and knowledge about the real world. When they are encouraged to work with the knowledge they have gained from their own experiences, they can develop strategies together to change their immediate situations. Such learning experiences may take place in several ways as described below Society for Participatory Research in Asia, Existing popular knowledge is recognized and valued. The learning process starts with the assumption that participants already possess some knowledge. Participants do not start with a clean slate. In this approach, the synthesis of popular knowledge with existing scientific knowledge strengthens the learning experience of the participants. New knowledge is built on the existing knowledge. In the learning process, the starting point for creating new knowledge is the existing knowledge that people already have, in particular the fundamental elements. As people begin to appreciate what they already know, they are more open to seek new information. This desire to seek new information and knowledge enhances the learning process. Participants learn to exercise control. The learning process puts emphasis on the active participation of participants in generating their own knowledge. This encourages them to take the responsibility for their own learning. It is this active posture which constitutes a powerful impetus for learning and for learners to exercise control over their learning. Learning becomes a collective process. One of the elements of NFE is the promotion of collective responsibility for seeking new knowledge. As a result, participants learn to get together, collectively seeking and analyzing information. Learning creates informed options. The very process of collectively analyzing a given situation throws up various alternatives. As part of the process of analysis, options are debated on the basis of concrete information. As a result, participants are able to accept and reject options on an informed basis. This creates a sense of empowerment, which is based on the confidence that the information has been understood and interpreted. Actions emerge out of this analysis. The very act of involvement in the process of analyzing a given reality creates a sense of ownership of that knowledge and a willingness to transform that situation. The participants are then able to take concrete actions. Guided by the above, where possible, facilitators should create a learning situation where adults can discover answers and solutions for themselves. People remember the things they have said themselves best, so facilitators should not speak too much. They need to give participants a chance to find solutions before adding important points that the group has not mentioned Hope and Timmel, In every assessment of the Philippine National IPM Programme, the very high degree of success attained by the programme activities was attributed to the participatory, experiential and discovery-based learning approaches in the FFS. During this period, DA was dependent on the academe for development, packaging, and to some extent, even in the implementation of crop protection programmes of the government. For this reason, curriculum development in crop protection was more often patterned after the pedagogical learning methods, which the academe were more familiar with. Thus, even the mandate of NCPC were developed to reflect the traditional didactic approach to crop protection, such as: In the s, however, a series of reorganization took place in the Philippine agricultural extension system. Firstly, the once centralized DA was decentralized, moving many research, training and extension functions from the central to the DA regional offices. Secondly, commodity agencies were created to do research, training and extension functions for various commodities. In , when IPM was proclaimed as the core crop protection policy in Philippine agriculture, CPD assumed a more important role in enhancing local implementation of applied research, training and extension programmes in crop protection. During this period, although the training approach was less participatory and experiential, many field-based activities were already conducted using hands-on and demonstration methods, which more or less approximated the current discovery-based approach of the FFSs. The latter approach, for instance, has enabled farmers mostly under paddy conditions to achieve in 3â€”5 days the capacity to separate out natural enemies from the key rice pests, understand and use action thresholds, and to apply insecticides judiciously Bautista and Sumangil, It is concerned with improving decision-making skills and stimulating organized action. Hence, the core of the IPM learning process is made up of farmers engaged in self-discovery, finding solutions to technical and social aspects of crop production. From a philosophical perspective, participation makes IPM farmers see themselves as unique individuals, and at the same time, active members of the farm community. Accepting participation as a basic human need implies that participation is a human right, and that it should be accepted and fostered for itself alone and for its results. This is quite possible if the basic paradigms on which agricultural institutions are currently built undergo significant change. Since the

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Philippine National IPM Program concept is participative and empowering, it also calls for a programme approach that is participative, collaborative, flexible, and network-based Medina and Callo, Jr. Thus, FFS farmer-participants meet for 14â€”16 weeks a whole cropping season , from land preparation to harvest. Through direct experience and critical analysis, farmers interpret their observations in the AESA to make field management decisions. An FFS therefore trains farmers to become experts in their own fields. Experiential learning approach In small group discussions, farmers share their ideas on what have been happening in the field and why these things are happening. Facilitators circulate among the group and help farmers analyze their observations by posing problems and create different scenarios. In the large group discussions, the small groups share their ideas with the whole FFS group. They also share additional information related to plant growth and ecosystem not covered by the group discussions. The TOT course requires trainee-participants to grow several fields of rice, corn or vegetable crops, and perform all the tasks, including land preparation, planting, weeding, fertilizing, managing pests and harvesting the crop. The trainee-participants conduct specific field studies addressing local field problems and share discovery activities that illustrate basic IPM principles. Trainees learn about experimental methods, statistics, economic analysis, and ecosystem analysis, so that they can better assist farmer groups in implementing local field studies. Group dynamics emphasizing horizontal communication and group cooperation are also part of the core of TOT curriculum. They guide farmers in making observations and analyses, and in conducting comparative IPM plots and other IPM study activities. Discovery-based learning techniques, experiential learning methods and cooperative approaches bring about creation of new knowledge, the sharing of knowledge and empowerment of farmers. Once the foundation is laid, farmers are better able to act on their own initiatives and to sharpen their observations, research and communicative skills. Reshaping public opinion through programme advocacy The National IPM Program takes a proactive stance in reshaping public opinion on pesticides by providing field orientation and information to national and local government officials and policy makers, journalists, NGOs and consumer groups. These include field days, folk media presentations, IPM fairs and exhibits, farmer-government dialogues and IPM farmer congresses. Building management expertise of LGUs on IPM for secondary and migrant pests, especially, the Malayan rice black bug, locusts, golden apple snail and rats. The expansion of the IPM farmer-to-farmer extension approach within agrarian reform centers with the Department of Agrarian Reform.

Chapter 2 : Integrated pest management in the Philippines.

Integrated Pest Management (IPM) is the proper selection and use of suitable pest management practices to reduce pest injury at levels below those causing significant loss.

Your home is one of the single largest investments you will make in your life. Just like all of your other investments you need to be protected. When it comes to protecting your investment from termites, and other destructive insects, we guarantee a safe, effective and professional job every time. Through years of education, training, modern technology and years of experience, we will be able to provide your home with the best protection possible. Our Company is an industry leader in the area of customizing treatments that provide the best protection at the lowest cost. We use every procedure on the market today and we bring unparalleled expertise in treating your home. We are the only company in the area that provides you with a choice of all current treatment options. We are ranked by many organizations as the top termite company in expertise in the world. We are committed to providing its clients high quality pest control and quality services while creating livable environments for our customers. We strive to be fair, honest, courteous, and professional in all our dealings. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. Entomologists and ecologists have urged the adoption of IPM pest control since the s. IPM allows for safer pest control. Like ants, and some bees and waspsâ€”which are all placed in the separate order Hymenopteraâ€”termites divide labor among castes, produce overlapping generations and take care of young collectively. Termites are major detritivores, particularly in the subtropical and tropical regions, and their recycling of wood and other plant matter is of considerable ecological importance. As eusocial insects, termites live in colonies that, at maturity, number from several hundred to several million individuals. Colonies use decentralised, self-organised systems of activity guided by swarm intelligence which exploit food sources and environments unavailable to any single insect acting alone. A typical colony contains nymphs semimature young , workers, soldiers, and reproductive individuals of both sexes, sometimes containing several egg-laying queens. This program includes pre-scheduled interior and exterior services over a 12 month period. Pest problems can become more than a minor nuisance and have the potential to cause major headaches. With some infestations, serious health dangers and potential property damage can pose a real threat to you and your family.

Chapter 3 : integrated pest management | TermaxPro Pest Control Services | Company in Metro Manila, P

Integrated pest management (IPM) is a holistic approach towards pest risk management by utilizing proactive control methods. It requires a combination of pest exclusion practices that involves good sanitation procedures along with extensive monitoring.

In addition to good crop management, timely and accurate diagnosis can significantly reduce losses. If you are facing a problem in your crop and need help with diagnosis, seek advice from a professional or use the Rice Doctor. The best control for pests and disease problems is prevention. To limit pest and disease damage: Practice good cleaning of equipment and field between seasons Practice good cleaning of equipment and field between seasons Diseases can be spread between fields or between seasons if you do not take proper precautions. After harvest, be sure to clean the harvesting equipment to prevent the spread of infected plants. Some diseases can live on the stubble between seasons and infect a healthy planted crop. In general, plowing after harvest removes stubble that serves as remaining food and shelter for pests, especially insects. In cases where your field was infested, you should remove all stubble from the previous season see disease section for more details. Clean the bunds and patch all rat holes on bunds and around your field. If there are nearby fallow fields or forested areas, you may want to have a community rat control effort or put up trap barriers to keep rats from damaging your crop see rat section for more details. Ratooning allowing your crop to sprout and continue growing after harvest is not recommended because diseases and insect hosts can be sustained from season to season. It is best to clean the field of any crop and leave it fallow for a few weeks to a few months before planting again. Choosing quality seed Many varieties have been developed with resistance to different diseases. You should check with your local extension agent or a nearby seed dealer to find out which resistant varieties they carry. Use short-duration and resistant cultivars to decrease insect pest populations. In short-duration cultivars, insects cannot compete as many generations, so populations may not reach damaging levels. Resistant varieties experience less feeding damage on their leaves and stems, which means less entry points for bacteria and fungal diseases. IRRI has a major responsibility to develop rice varieties for the benefit of rice farmers and consumers. Plant at the same time as your neighbors Plant at the same time as your neighbors Planting at the same time or within a 2 week window as the neighboring fields can help to minimize insect, disease, bird, and rat pressure on individual fields. Do not over apply fertilizer Do not over apply fertilizer High nitrogen can increase susceptibility to certain pests and diseases that is why specific fertilizer recommendations is very important. Encourage natural pest enemies Encourage natural pest enemies Overuse of pesticide is common among farmers and can actually lead to pest outbreaks. Natural insect enemies of the rice pests are also killed when pesticides are applied and this can lead to an outbreak of other rice insect pests. Other ways to encourage natural pest enemies are to allow plants on the bunds and between fields to flower yellow and white flowers attract natural enemies. Do not apply pesticide within 40 days of planting Do not apply pesticide within 40 days of planting Generally, a rice crop can recover from early damage without affecting yield. Clean the grain before storing so it is free of dust, chaff, and excessive broken grains. The storage area should be clean and have a dampproof floor and waterproof walls and roofs. Ideally, the storage area should be sealed to keep out rats and birds and to allow for fumigation if necessary. Stack bags on a pallett with at least 50cm of space on every side of the stack. Do not store grain for more than 6 months. Do not store new grain next to old grain that is infested with insects. Store grain as paddy or rough rice because it is less prone to insect attack than milled rice. Parboiled rice is also less susceptible to damage than raw rice.

Chapter 4 : What Is Integrated Pest Management (IPM)? / UC Statewide IPM Program (UC IPM)

Status of integrated pest management in the Philippines. Paper presented for the Workshop on Integrated Pest Management and Integrated Nutrient Management held on July at the International Rice Research Institute, Los BaÃ±os, Laguna. 15 pp.

Integrated Pest Management in mango is successful Aug. Mango pulp weevil is a serious pest in mango in Palawan. The weevil lays its eggs in the developing fruit and when these hatch, the larvae feed on the flesh. While the infested fruit may look unblemished, the pulp inside has hardened and dry brown chambers can be seen due to the feeding of the MPW larvae. Anthracnose, on the other hand, is a fungal disease that infects the fruits, leaves, flowers and stems. Infected fruits develop tiny brown spots that enlarge into tear-shape pattern as the fruit ripens. Anthracnose is the most serious disease in mango and also attacks many other crops. In the IPM project for mango pulp weevil, the technicians adopted innovative cultural methods such as open center pruning, and sanitation as well as chemical control. The open center pruning ensures more sunlight penetration in the tree canopy that becomes unfavorable for MPW to inhabit. Sanitation, on the other hand, destroys the habitat of the weevil. This involves removal of the dead branches, twigs, weeds and fallen leaves. The IPM for anthracnose aimed to reduce the infection on mango leaves and fruits. The technology involves sanitation, chemical control, bagging and pruning. Sanitation is done throughout the year to remove dead branches and decayed leaves. Fungicide application is done continuously starting on the 10th day after flower induction DAFI until the fruits are 10 to 20 days to harvest. Fruit bagging is done 50 to 60 DAFI. In both Palawan and Davao Oriental, the technologies were disseminated to the farmers through trainings and demonstrations. And what are the findings? The IPM interventions which were promoted in the provinces where they were conducted resulted in the decline in pest and disease incidence. There was also an improvement in fruit quality and farm productivity. Although the cost involved in the IPM-treated farms was higher, the income of the farmers using the IPM technology increased tremendously. Here are the results in Palawan. While the IPM technology was more expensive to do, the profit per tree of P12, is much higher than the net income of the other growers at P1, per tree per year. In Palawan, the cost of pest management by growers trained in IPM is 29 percent higher than other mango growers. But the IPM-trained farmers were able to recover the additional cost and generate higher net income of percent more in Palawan and percent more in Davao. This was due to the reduction in pest and disease incidence and improvement in yield. MPW infestation was lower by 53 percent in fruits produced by the IPM farmers in Palawan while incidence of anthracnose was lower by 39 percent in farms of those trained in Davao. As a result, the yield of trained farmers increased by percent in Palawan and percent in Davao.

Chapter 5 : Integrated Pest Management (IPM) - FastKil Pest Control Services

Integrated Pest Management (IPM) is a decision-making process that anticipates and prevents pest activity and infestation by combining several strategies to achieve long-term solutions.

IPM Programs Integrated pest management, or IPM, is a process you can use to solve pest problems while minimizing risks to people and the environment. IPM can be used to manage all kinds of pests anywhereâ€”in urban, agricultural, and wildland or natural areas. Definition of IPM IPM is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment. What is a pest? Pests are organisms that damage or interfere with desirable plants in our fields and orchards, landscapes, or wildlands, or damage homes or other structures. Pests also include organisms that impact human or animal health. Pests may transmit disease or may be just a nuisance. A pest can be a plant weed , vertebrate bird, rodent, or other mammal , invertebrate insect, tick, mite, or snail , nematode, pathogen bacteria, virus, or fungus that causes disease, or other unwanted organism that may harm water quality, animal life, or other parts of the ecosystem. IPM focuses on long-term prevention of pests or their damage by managing the ecosystem With IPM, you take actions to keep pests from becoming a problem, such as by growing a healthy crop that can withstand pest attacks, using disease-resistant plants, or caulking cracks to keep insects or rodents from entering a building. Armed with this information, you can create conditions that are unfavorable for the pest. Correctly identifying the pest is key to knowing whether a pest is likely to become a problem and determining the best management strategy. After monitoring and considering information about the pest, its biology, and environmental factors, you can decide whether the pest can be tolerated or whether it is a problem that warrants control. If control is needed, this information also helps you select the most effective management methods and the best time to use them. IPM programs combine management approaches for greater effectiveness The most effective, long-term way to manage pests is by using a combination of methods that work better together than separately. Approaches for managing pests are often grouped in the following categories. Biological control Biological control is the use of natural enemiesâ€”predators, parasites, pathogens, and competitorsâ€”to control pests and their damage. Invertebrates, plant pathogens, nematodes, weeds, and vertebrates have many natural enemies. Cultural controls Cultural controls are practices that reduce pest establishment, reproduction, dispersal, and survival. For example, changing irrigation practices can reduce pest problems, since too much water can increase root disease and weeds. Mechanical and physical controls Mechanical and physical controls kill a pest directly, block pests out, or make the environment unsuitable for it. Traps for rodents are examples of mechanical control. Physical controls include mulches for weed management, steam sterilization of the soil for disease management, or barriers such as screens to keep birds or insects out. Chemical control Chemical control is the use of pesticides. In IPM, pesticides are used only when needed and in combination with other approaches for more effective, long-term control. Pesticides are selected and applied in a way that minimizes their possible harm to people, nontarget organisms, and the environment. While each situation is different, six major components are common to all IPM programs:

Chapter 6 : Pests and diseases - IRRI Rice Knowledge Bank

Integrated Management of the pest is used. So this chapter Integrated pest management can be divided into 2 main paddy in the Philippines.

For more information What is IPM? Integrated Pest Management IPM is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment. The IPM approach can be applied to both agricultural and non-agricultural settings, such as the home, garden, and workplace. IPM takes advantage of all appropriate pest management options including, but not limited to, the judicious use of pesticides. IPM is not a single pest control method but, rather, a series of pest management evaluations, decisions and controls. In practicing IPM, growers who are aware of the potential for pest infestation follow a four-tiered approach. The four steps include: Set Action Thresholds Before taking any pest control action, IPM first sets an action threshold, a point at which pest populations or environmental conditions indicate that pest control action must be taken. Sighting a single pest does not always mean control is needed. The level at which pests will either become an economic threat is critical to guide future pest control decisions. Monitor and Identify Pests Not all insects, weeds, and other living organisms require control. Many organisms are innocuous, and some are even beneficial. IPM programs work to monitor for pests and identify them accurately, so that appropriate control decisions can be made in conjunction with action thresholds. This monitoring and identification removes the possibility that pesticides will be used when they are not really needed or that the wrong kind of pesticide will be used. Prevention As a first line of pest control, IPM programs work to manage the crop, lawn, or indoor space to prevent pests from becoming a threat. In an agricultural crop, this may mean using cultural methods, such as rotating between different crops, selecting pest-resistant varieties, and planting pest-free rootstock. These control methods can be very effective and cost-efficient and present little to no risk to people or the environment. Control Once monitoring, identification, and action thresholds indicate that pest control is required, and preventive methods are no longer effective or available, IPM programs then evaluate the proper control method both for effectiveness and risk. If further monitoring, identifications and action thresholds indicate that less risky controls are not working, then additional pest control methods would be employed, such as targeted spraying of pesticides. Broadcast spraying of non-specific pesticides is a last resort. With these steps, IPM is best described as a continuum. Many, if not most, agricultural growers identify their pests before spraying. A smaller subset of growers use less risky pesticides such as pheromones. All of these growers are on the IPM continuum. The goal is to move growers further along the continuum to using all appropriate IPM techniques. There is no national certification for growers using IPM, as the United States Department of Agriculture has developed for organic foods. Since IPM is a complex pest control process, not merely a series of practices, it is impossible to use one IPM definition for all foods and all areas of the country. Many individual commodity growers, for such crop as potatoes and strawberries, are working to define what IPM means for their crop and region, and IPM-labeled foods are available in limited areas. With definitions, growers could begin to market more of their products as IPM-Grown, giving consumers another choice in their food purchases. Yes, the same principles used by large farms can be applied to your own garden by following the four-tiered approach outlined above. For more specific information on practicing IPM in your garden, you can contact your state Extension Services for the services of a Master Gardener.

Chapter 7 : Integrated pest management - Wikipedia

Integrated pest management, or IPM, is a process you can use to solve pest problems while minimizing risks to people and the environment. IPM can be used to manage all kinds of pests anywhere-in urban, agricultural, and wildland or natural areas.

The Sustainable Intensification of Agriculture In the past half century, there has been remarkable growth in food production, with increases across the world since the s. During the second half of the 20th century, intensification was the prime driver of increased per capita food production globally. The greatest increases have been in China, where a five-fold increase occurred. Over the same period, world population has grown from three to more than seven billion. Again, though, per capita agricultural production has outpaced population growth. The desire for agriculture to produce more food without environmental harm, or even positive contributions to natural and social capital, has been reflected in calls for a wide range of different types of more sustainable agriculture: Others have called for new paradigms to rethink agriculture [56], and for major progress towards sustainable intensification [45]. All centre on the proposition that agricultural and uncultivated systems should no longer be conceived of as separate entities. In light of the need for the sector to contribute directly to the resolution of other global social-ecological challenges, there have also been calls for nutrition-sensitive [57], climate-smart [58] and low-carbon [59] agriculture. Sustainable production systems should exhibit a number of core attributes [42 , 60 , 61]. Utilise crop varieties and livestock breeds with a high ratio of productivity to use of externally- and internally-derived inputs; Avoid the unnecessary use of external inputs; Harness agroecological processes such as nutrient cycling, biological nitrogen fixation, allelopathy, predation and parasitism; Minimise use of technologies or practices that have adverse impacts on the environment and human health; Make productive use of human capital in the form of knowledge and capacity to adapt and innovate and social capital to resolve common landscape-scale or system-wide problems such as water, pest or soil management ; Minimise the impacts of system management on externalities such as greenhouse gas emissions, clean water, carbon sequestration, biodiversity, and dispersal of pests, pathogens and weeds. Agricultural systems emphasizing these principles tend to display a number of broad features that distinguish them from the process and outcomes of conventional systems. First, these systems tend to be multifunctional within landscapes and economies [54 , 62 , 63 , 64 , 65]. They jointly produce food and other goods for farmers and markets, while contributing to a range of valued public goods, such as clean water, wildlife, and habitats, carbon sequestration, flood protection, groundwater recharge, landscape amenity value and leisure and tourism opportunities. In their configuration, they capitalise on the synergies and efficiencies that arise from complex ecosystem, social and economic interactions [48]. Second, these systems are diverse, synergistic and tailored to social-ecological context. There are many pathways towards agricultural sustainability, and no single configuration of technologies, inputs and ecological management is more likely to be widely applicable than another. Agricultural sustainability implies the need to fit these factors to the specific circumstances of different agricultural systems [66] Challenges, processes and outcomes will also vary across agricultural sectors: Third, these systems often involve more complex mixes of domesticated plant and animal species and associated management techniques, requiring the deployment of greater skills and knowledge by farmers. To increase production efficiently and sustainably, farmers need to understand under what conditions agricultural inputs seeds, fertilizers, and pesticides can either complement or contradict biological processes and ecosystem services that inherently support agriculture [43 , 68]. In all cases farmers need to see for themselves that added complexity and increased knowledge can result in substantial net benefits to productivity. Fourth, these systems depend on new configurations of social capital, comprising relations of trust embodied in social organizations, horizontal and vertical partnerships between institutions, and human capital comprising leadership, ingenuity, management skills, and capacity to innovate. Agricultural systems with high levels of social and human assets are able to innovate in the face of uncertainty [69 , 70 , 71] and farmer-to-farmer learning has been shown to be particularly important in implementing the context-specific, knowledge-intensive and regenerative practices of sustainable intensification [68 , 72 , 73].

Conventional thinking about agricultural sustainability has often assumed that a net reduction in input use, makes such systems essentially extensive requiring more land to produce the same amount of food. Organic systems often accept lower yields per area of land in order to reduce input use and increase the positive impact on natural capital. However, such organic systems may still be efficient if management, knowledge and information are substituted for purchased external inputs. Recent evidence shows that successful agricultural sustainability initiatives and projects arise from shifts in the factors of agricultural production e. A better concept than extensive is one that centres on intensification of resources, making better use of existing resources e. The combination of the terms is an attempt to indicate that desirable ends more food, better environment could be achieved by a variety of means. The term was further popularised by a number of key reports: Sustainable intensification SI is defined as a process or system where yields are increased without adverse environmental impact and without the cultivation of more land [42]. The concept is thus relatively open, in that it does not articulate or privilege any particular vision of agricultural production [81 , 82 , 83]. It emphasises ends rather than means, and does not predetermine technologies, species mix, or particular design components. This further suggests the need for wider sets of indicators to measure impacts [65 , 84]. IPM delivers on a key principle of sustainable intensificationâ€"the use of methods and practices that maintain or improve agricultural productivity whilst both reducing negative impacts and increasing positive outcomes for natural capital and ecosystem services. It, thus, has a role to play in making transitions towards more sustainable systems that can feed a world population that is both growing and changing its consumption patterns [85]. Principles and Implementation IPM emerged after WWII following the recognition that indiscriminate use of insecticide would be ecologically problematic. Since then, it has been stated that IPM has become the dominant crop protection paradigm, yet its adoption remains low [87]. As indicated earlier, it has not yet led to a reduction in total pesticide use, nor has it yet eliminated negative externalities. There are also an increasing number of new invasive pests and diseases being discovered, as transfer of species in a globalised world has become easier, and changes in climate and weather patterns have driven shifts in pest and pathogen ranges. Effective IPM centres on the principle of deploying multiple complementary methods for pest, weed and disease control. This broad range of options allows for many interpretations of IPM [83 , 87]. IPM approaches can be classified into four main types Table 5. These vary along a spectrum from targeted or changed use of pesticide compounds to habitat and agroecological design. In only very rare cases, such as the aerial release of the parasitic wasp, Epidinocarsis lopezi, to control cassava mealybug in West and Central Africa [88 , 89], can IPM be implemented without farmer engagement in locally-relevant and effective methods for IPM. The principles are to find appropriate ways of building the natural, social and human capital in ecosystems such that these provide sufficient services to maintain or increase agricultural productivity whilst reducing or eliminating environmental harm.

Chapter 8 : What Is Integrated Pest Management? â€” Beyond Pesticides

Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment.

History[edit] Shortly after World War II, when synthetic insecticides became widely available, entomologists in California developed the concept of "supervised insect control". Under this scheme, insect control was "supervised" by qualified entomologists and insecticide applications were based on conclusions reached from periodic monitoring of pest and natural-enemy populations. This was viewed as an alternative to calendar-based programs. Supervised control was based on knowledge of the ecology and analysis of projected trends in pest and natural-enemy populations. Supervised control formed much of the conceptual basis for the "integrated control" that University of California entomologists articulated in the s. Integrated control sought to identify the best mix of chemical and biological controls for a given insect pest. Chemical insecticides were to be used in the manner least disruptive to biological control. The term "integrated" was thus synonymous with "compatible. IPM extended the concept of integrated control to all classes of pests and was expanded to include all tactics. Controls such as pesticides were to be applied as in integrated control, but these now had to be compatible with tactics for all classes of pests. Other tactics, such as host-plant resistance and cultural manipulations, became part of the IPM framework. IPM combined entomologists, plant pathologists , nematologists and weed scientists. IPM holds that wiping out an entire pest population is often impossible, and the attempt can be expensive and unsafe. IPM programmes first work to establish acceptable pest levels, called action thresholds, and apply controls if those thresholds are crossed. These thresholds are pest and site specific, meaning that it may be acceptable at one site to have a weed such as white clover , but not at another site. Allowing a pest population to survive at a reasonable threshold reduces selection pressure. This lowers the rate at which a pest develops resistance to a control, because if almost all pests are killed then those that have resistance will provide the genetic basis of the future population. Retaining a significant number of unresistant specimens dilutes the prevalence of any resistant genes that appear. Similarly, the repeated use of a single class of controls will create pest populations that are more resistant to that class, whereas alternating among classes helps prevent this. Beneficial fungi and bacteria are added to the potting media of horticultural crops vulnerable to root diseases, greatly reducing the need for fungicides. Observation is broken into inspection and identification. Record-keeping is essential, as is a thorough knowledge of target pest behavior and reproductive cycles. Since insects are cold-blooded, their physical development is dependent on area temperatures. Many insects have had their development cycles modeled in terms of degree-days. The degree days of an environment determines the optimal time for a specific insect outbreak. Plant pathogens follow similar patterns of response to weather and season. Mechanical controlsâ€”Should a pest reach an unacceptable level, mechanical methods are the first options. They include simple hand-picking, barriers, traps, vacuuming and tillage to disrupt breeding. Biological controls â€”Natural biological processes and materials can provide control, with acceptable environmental impact, and often at lower cost. The main approach is to promote beneficial insects that eat or parasitize target pests. Biological insecticides , derived from naturally occurring microorganisms e. Many newer pesticides are derived from plants or naturally occurring substances e. Applications of pesticides must reach their intended targets. Matching the application technique to the crop, the pest, and the pesticide is critical. The use of low-volume spray equipment reduces overall pesticide use and labor cost. An IPM regime can be simple or sophisticated. Historically, the main focus of IPM programmes was on agricultural insect pests. Process[edit] IPM is the selection and use of pest control actions that will ensure favourable economic, ecological and social consequences [12] and is applicable to most agricultural, public health and amenity pest management situations. The IPM process starts with monitoring, which includes inspection and identification, followed by the establishment of economic injury levels. The economic injury levels set the economic threshold level. That is the point when pest damage and the benefits of treating the pest exceed the cost of treatment. Action thresholds are more common in structural pest management and economic injury levels in classic agricultural pest management. An example of an action threshold is one fly in a hospital operating room is not acceptable, but one fly in a pet kennel would be acceptable. Once a threshold has been crossed by the pest population action steps need to be taken to reduce and control the pest. Integrated pest management employ a variety of actions including cultural controls, including physical barriers, biological controls, including adding and conserving natural predators and enemies to the pest, and finally chemical controls or pesticides. Reliance on knowledge, experience, observation and integration of multiple techniques makes IPM appropriate for organic farming excluding synthetic pesticides. These may or may not include materials listed on the Organic Materials Review Institute OMRI [14] Although the pesticides and particularly insecticides used in organic farming and organic gardening are generally safer than synthetic pesticides, they are not always more safe or environmentally friendly than synthetic pesticides and can cause harm. Risk assessment usually includes four issues: Overall plant health and resistance to pests is greatly influenced by pH , alkalinity , of dissolved mineral and oxygen reduction potential. Many diseases are waterborne, spread directly by irrigation water and indirectly by splashing. Once the pest is known, knowledge of its lifecycle provides the optimal intervention points. Pest-tolerant crops such as soybeans may not warrant interventions unless the pests are numerous or rapidly increasing. Intervention is warranted if the expected cost of damage by the pest is more than the cost of control. Health hazards may require intervention that is not warranted by economic considerations. Specific sites may also have varying requirements. Cultural controls include keeping an area free of conducive conditions by removing waste or diseased plants, flooding, sanding, and the use of disease-resistant crop varieties. Augmentative control includes the periodic introduction of predators. This is commonly used in greenhouses. Biological controls can be used to stop invasive species or pests, but they can become an introduction path for new pests. A green pest management IPM program uses pesticides derived from plants, such as botanicals, or other naturally occurring materials. Pesticides can be classified by their modes of action. Rotating among materials with different modes of action minimizes pest resistance. Pesticide imports by 11 Southeast Asian countries grew nearly sevenfold in value between and , according to FAO statistics, with disastrous results. Rice farmers become accustomed to spraying soon after planting, triggered by signs of the leaf folder moth, which appears early in the growing season. In , Indonesia banned 57 pesticides and completely stopped subsidizing their use. Progress was reversed in the s, when growing production capacity, particularly in China, reduced prices. Rice production in Asia more than doubled. Since , outbreaks have devastated rice harvests throughout Asia, but not in the Mekong Delta. Reduced spraying allowed natural predators to neutralize planthoppers in Vietnam. The Thai government is now pushing the "no spray in the first 40 days" approach. Planthoppers now require pesticide doses times greater than originally. Overuse indiscriminately kills beneficial insects and decimates bird and amphibian populations. Pesticides are suspected of harming human health and became a common means for rural Asians to commit suicide. In one plot, each farmer grew rice using their usual amounts of seed and fertilizer, applying pesticide as they chose. In a nearby plot, less seed and fertilizer were used and no pesticides were applied for 40 days after planting. The experiment led to the "three reductions, three gains" campaign, claiming that cutting the use of seed, fertilizer and pesticide would boost yield, quality and income. Posters, leaflets, TV commercials and a radio soap opera that featured a rice farmer who gradually accepted the changes. Mekong Delta farmers cut insecticide spraying from five times per crop cycle to zero to one. The Plant Protection Center and the International Rice Research Institute IRRI have been encouraging farmers to grow flowers, okra and beans on rice paddy banks, instead of stripping vegetation, as was typical. The plants attract bees and a tiny wasp that eats planthopper eggs, while the vegetables diversify farm incomes. A proposed law in Vietnam requires licensing pesticide dealers and government approval of advertisements to prevent exaggerated claims.

Chapter 9 : Integrated Pest Management for Sustainable Intensification of Agriculture in Asia and Africa

Integrated Pest Management (IPM) is an environmentally friendly, common sense approach to controlling pests. The IPM principles and benefits described below apply to any type of structure and landscaping.