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PEST MANAGEMENT FOR ENHANCED CROP PRODUCTIVITY

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ABSTRACT

The farmers can increase their income by adopting technologies like crop rotation, integrated farming, organic farming, double/triple cropping system by the farmers instead of relying on traditional farming. Farmers lose an estimated average of 37% of their rice crop to pests and diseases every year. In addition to good crop management, timely and accurate diagnosis can significantly reduce losses. Crop problems can be caused by other living organisms, like rats and fungus, or by non-living factors, such as wind, water, temperature, radiation, and soil acidity. It creates problems for productivity and finally reached loss income. Maintenance of crop health is essential for successful farming for both yield and quality of produce. This requires long-term strategies for the minimization of pest and disease occurrence preferably by enhancing natural control mechanisms, growing a "healthy crop". Specific measures include the use of disease- and pest-resistant crops, rotation of crops, including those with pasture, to provide disease breaks for susceptible crops, apply non-chemical control practices(thermic, mechanical) as applicable and as last resort the tactical use of agrochemicals to control weeds, pests, and diseases following the principles of IPM and guidelines of good application practices. The developments in IPM over the years have been the tendency to generalize and make recommendations for farmers across large and highly heterogeneous areas. This has been true for all manner of input recommendations including fertilizers, pesticides and crop varieties.

KEYWORDS: Agriculture, Crop Management, Pesticide, Pest resistant Crops, IPM

The role of pesticides has become critically important with modernization of agriculture. Modernization of agriculture implies increased use of modem inputs such as chemical fertilizer, irrigation and modern seeds, which provide a favourable climate for rapid growth of pests. The term *pesticide* has been around for centuries, and it comprises different types of chemicals pesticide use which has been applying for agriculture purpose like,

- Substantial use of pesticide increased crop yield and quality
- Lessened the workload of pest management, and
- improved the scenario for long term sustainable food production

Modern seeds are more susceptible to insect pests and diseases. Non-optimal and non judicious use of pesticides may result in a series of problems related to both loss of their effectiveness in the long run and certain externalities like pollution and health hazards.

PEST MANAGEMENT

Includes weed, insect, disease, and other threats to crop development, yield, and quality and what protective or remedial measures to take against the pest.

Pest management is only one component of agricultural production, but one that has important economic consequences associated with control options, including control costs, production outcomes, and environmental and societal effects. Understanding the economic value of the key ecosystem services supplied by BC will help to broaden its utility in crop protection and raise its stock among all stakeholders of agriculture, including those who make funding decisions that's pur needed innovations.

Intellectual use of pesticides has led to crop management that is more efficient, sustainable, and productive (United Nations 2012). There are controversies and challenges, but with effective policies, proper guideline, and safety training, pesticide use will continue to play asignificant role in food production. There is extensive recognition among agricultural scientists that a growing world population will consume greater amounts of food and fiber with fewer resources available for production (Brussard *et al.,* 1998). The challenge to meet the increasing demands for food and fiber by a rapidly growing global population requires innovative solutions. Pesticides having some undesirable effect on environment and human health, several countries are introducing integrated pest management (IPM) technologies which are based on the natural balancing forces in ecological system. A key part to meeting these demands will be protecting crops from pest losses while conserving limited natural resources and maintaining environmental quality through ecologically and

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economically sound integrated pest management (IPM) practices.

The use of synthetic pesticides presents extra challenges and that alternative methods need to be applied, which diminish pest damage at the same time avoiding the cost and negative outcomes related with synthetic pesticides.

Integrated pest management (IPM) is an environmentally friendly technology. This technique is an essential step towards providing healthy, feasible food for a growing global population. Currently, more than 80% of farmers rely on pesticides. IPM practices are an effective strategy for obtaining high rice yields while protecting the environment and creating a more sustainable agro ecosystem. Furthermore, the need for ongoing research and training on IPM methods will be essential for creating a sustainable rice agro ecosystem. Pest insect species can be categorized as minor and major pests. These pests cause severe damage to rice crops at different growth stages. The degree of damage is dependent on the growing season and surrounding environment (Nivelle *et al*., 2016).

Importantly, the IPM framework creates a management environment in which farmers can build stable in-field habitats that will facilitate a miscellaneous community of native and exotic beneficial arthropods prepared to attack emergent pest populations. In addition IPM can be modified to different systems with unique pest pressures and management requirements. Adopting cover crops and eliminating till age will not work for every crop, climate, and geological landscape, (Morris *et al*., 2010, Pisa *et al*., 2015), but farmers can work with in an IPM framework to adopt other in-field strategy that lessen disturbance and mitigate for field activities.

The Benefits and Costs of Pesticide Use

Pesticides are intended to be hazardous. Their value lies in their ability to kill unwanted organisms. Most act by interfering with biochemical and physiological processes that are common to a wide range of organisms, including, not only pests, weeds, and fungi, but also wildlife and humans. The risks differ from compound to compound, and much of the information on their side-effects remains widely contested. There is no agreed evidence quantifying the harm they do to natural capital or human health, nor a unified view of benefits and costs (Fantke *et al*., 2012).

Use of Recommended Quantity

More than one-half of the farmers use suggested quantity of pesticides in their crops (Table 1).The study shows remarkable result that large proportion of small and medium farmers use excess amount compared with large farmers.

Table 1: Using recommended quantity of pesticides (% of farmer)

Type of farmer	Recommended quantity	More than recommended quantity	Less than recommended quantity
Small	62.11	19.82	18.06
medium	52.78	27.78	19.44
large	65.52	3.45	31.03
all	60.37	20.12	19.51

Challenge of Pest Management and Pesticide Use Globally

Pathogens, weeds, and invertebrates cause significant crop losses worldwide, and in doing so present a barrier to the achievement of global food security and poverty reduction. Estimates of the scale of these losses vary by context and scope. Viewed in terms of food security, crops losses to pests may represent the equivalent of food required to feed over 1 billion people (Birch *et al*., 2011). Pesticides have long been used to control pests and diseases in agriculture (Carson *et al*., 1962, Conway *et al*., 1991, Pretty *et al*., 2005, Zhang *et al*., 2011). Key aspects of sustain able agricultural systems include meeting food and fiber production needs in an economically viablemanner, while improving environmental health and individual and societal well-being (Khoury *et al*., 2016).

Adaptable Management Practices

Pest management strategies that rely on chemical inputs are rather one-dimensional, habitat management provides benefits beyond pest control. Off-field manipulations such as hedgerow sand flowering borders provide "stacked" ecosystem services—pollinator habitat, natural-enemy habitat, erosion control, and aesthetic value (Fiedler *et al*., 2012). In-field practices, like reduced tillage an duse of cover crops, also provide stacked services, and are traditionally first adopted for erosion control, improving soil quality, and nutrient management before their pest control benefits are even considered (Varela *et al*., 2017).

In-field practices are adopted for just one of these benefits; the other benefits remain and often stem from increased community diversity (Wagg *et al*., 2014). Reduced tillage and cover crops have even been identified as valuable tools for mitigating and adapting to elevated carbon dioxide and climate change (Kaye *et al*., 2017), further facts that these practices are likely to have positive externalities, unlike the environmental trade-offs distinctive of prophylactic pesticide use and tillage. The key "other" services exhibited by the soil community is decomposition, which is crucial for residue breakdown and nutrient cycling. Conserving natural enemies and cover crops as a part of IPM also protects the invertebrate species which is responsible for decomposition, further concerning pest management with nutrient cycling and soil quality.

Utilization of Decomposers as Substitute for Arthropod Bio Control Agents

Methods supervising habitats that precisely diminish predator fatality (residue retention, cover crops, and diminished pesticide utilization) also promote a divergent decomposer community (Van Gestel *et al*., 2017, De Lima e Silva *et al*., 2017, Dureja *et al*., 2012, Wickings *et al*., 2011). The microbivore community along with decomposer community constitute a diversification of macro fauna (diplopods, earthworms, isopods) and mesofauna (mites, enheitraeids, collembola) which stimulate debris disintegration and nutrients mobilization (Ossola et al., 2016). An effective community of decomposers is further beneficial in no- till set ups, where invertebrate actions are crucial for material assimilation and nutrients discharge to the soil (Hendrix *et al*., 1986, House *et al*., 1985).

The Decomposers maintain a helpful substitute of food for commonplace predators when populations of pest are depressed (Landis *et al*., 2000, Agusti *et al*., 2003, Symondson *et al*., 2000) and when populations of pests expand.

Needs of Future Research

Habitat manipulation can promote predator populations that can support with pest control, research gaps remain and this need to be addressed to have a improved perceptive of how in-field management practices affects communities of beneficial arthropods. The present need of future research is that there should be increased focus on how to co-adopted management practices influence biotic contacts within the soil community. Secondly, changes to the soil community that might affect many functions (e.g., pest control and nutrient cycling).

Experiments should be developed to capture the changes to soil communities and ecosystem services when farmers shift from conventional management to reduced tillage, cover crops, and IPM; similar studies have been conducted during the transition from conventional to organic production and can help explain challenges such as temporary yield drag (Rivers *et al*., 2017). These future studies should include community-level endpoints (e.g., decomposition, pollination, and pest suppression) as opposed to relying just on measures of relative species abundance because functional diversity and raw biodiversity may not be well correlated in novel agro ecosystems with many exotic species.

There isalso value in investigating the relative contribution of native fauna versus exotic fauna to ecosystem services in agro ecosystems perhaps leading to more recognition and facilitation of beneficial exotics which are already well established across agro ecosystems (Carroll et al., 2011). Additionally, we know very little about how prophylactic pesticides interact with cover crops, reduced tillage, and soil quality; it would be valuable to know if beneficial management practices can ameliorate negative effects of prophylactic pesticides, or if these practices are incompatible.

CONCLUSIONS

Holistic management practices, including cover cropping, reducing tillage, and reducing pesticide use, are in-field habitat manipulations that can promote a diverse soil community and should increase arthropod control of pests, reducing dependence on cultivation and pesticide applications. The use of arthropods in agriculture likely to be novel and their use in-field practice are principally valuable for maintaining exotic predators that significantly contribute to pest control. To maintain predators in fields, there is require to decrease disturbances caused by field activities, and to compensate for inevitable disturbances to stabilize the soil community. Belowground pests in particular are challenging to monitor and treat, so control tactics are limited. Management tools that supply balance between stability and interruption, and are implement with IPM, will increase the value of biological control services given by the soil communities to control the belowground pests.

All the management practices, particularly reduced tillage and cover crops, offer additional agronomic and environmental profit that can increase the flexibility of a system to nutrient limitations, pest pressures, and also climate change. Further future study should be explored on the effects of management activities on the entire soil community and various ecosystem services that include the utilization of a decomposer community for pest management.To develop the long-term sustainability of farming, there is a strong need for farmers toadopt holistic in-field manipulations that promote functional diversity of soil communities.

Decomposers communities control crucial ecosystem functions, which directly benefit farmers managing their fields. Evidence suggests overuse of pesticides and could be reduced by over 40% with no yield or profit loss (Lechenet *et al*., 2017). Application of IPM and habitat management practice could promote to reducepesticide use.

The present challenge is to get more farmers to make use of IPM. Importantly, this involves working with farmers and their advisors to understand how to assess pest populations in their fields as well as the strength and limitation of practices that are present to manage the invertibrate pest populations that they encounter (Baumgart-Getz *et al.*, 2012), relatively relying on needless preventive pest control strategy.

REFERENCES

Agusti N., Shayler S.P., Harwood J.D., Vaughan I.P., Sunderland K.D. and Symondson W.O.C., 2003. Collembola asalternative prey sustaining spiders in arable ecosystems: Prey detection within predators using molecularmarkers. Mol. Ecol., **12**: 3467–3475.

Baumgart-Getz A., Prokopy L.S. and Floress K., 2012. Why farmers adopt best management practice in the United States: A meta-analysis of the adoption literature. J. Environ. Manage., **96**: 17–25.

Birch A.N.E., Begg G.S. and Squire G.R., 2011. How agro-ecological research helps to address food security issues under new IPM and pesticide reduction policies for global crop production systems. J. Exp. Biol., **62**: 3251–3261.

Brussard P.F., Reed J.M. and Tracy C.R., 1998. Ecosystem management: What is it really? Landsc. Urban Plan, **40**: 9–20.

Carroll S.P., 2011. Conciliation biology: The eco-evolutionary management of permanently invaded biotic systems: Conciliation biology. Evol. Appl., **4**: 184–199. Carson, R. *Silent Spring*; Houghton Mifflin: Boston, MA, USA, 1962.

Conway G.R. and Pretty J., 1991. Unwelcome Harvest: Agriculture and Pollution; Earthscan: London, UK.

De Lima e Silva C., Brennan N., Brouwer J.M., Commandeur D., Verweij R.A. and vanGestel C.A.M., 2017. Comparative toxicity of imidacloprid and thiacloprid to different species of soil invertebrates. Ecotoxicology.

Dureja P. and Tanwar R.S., 2012. Pesticide Residues in Soil Invertebrates. In Pesticides: Evaluation of Environmental Pollution; Hamir, S.R., Leo, M.L.N., Eds.; CRC Press: Boca Raton, FL, USA, pp. 337–359.

Fantke P., Friedrich R. and Jolliet O., 2012. Health impact and damage cost assessment of pesticides in Europe. Environ. Int., **49**: 9–17.

Fiedler A.K., Landis D.A. and Wratten S.D., 2008. Maximizing ecosystem services from conservation biologicalcontrol: The role of habitat management. Biol. Control, **45**: 254–271.

Hendrix P.F., Parmelee R.W., Crossley D.A., Coleman D.C., Odum E.P. and Groffman, P.M., 1986. Detritus food websin conventional and no-tillage agroecosystems. Bio Science, **36**, 374–380.

House G.J. and Parmelee R.W., 1985. Comparison of soil arthropods and earthworms from conventional and no-tillageagroecosystems. Soil Tillage Res., **5**:351–360.

Kaye J.P. and Quemada M., 2017. Using cover crops tomitigate and adapt to climate change. Areview.Agron. Sustain. Dev., 37.

Khoury C.K., Achicanoy H.A., Bjorkman A.D., Navarro-Racines C., Guarino L., Flores-Palacios X., Engels J.M.M., Wiersema J.H., Dempewolf H. and Sotelo S., 2016. Origins of food crops connect countries worldwide. Proc. R. Soc. B. Biol. Sci.

Landis D.A., Wratten S.D. and Gurr G.M., 2000. Habitat management to conserve natural enemies of arthropod pestsin agriculture. Annu. Rev. Entomol., **45**: 175–201.

Lechenet M., Dessaint F., Py G., Makowski D. and Munier-Jolain N., 2017. Reducing pesticide use while preservingcrop productivity and profitability on arable farms. Nat. Plants, **3**: 17008.

Morris N.L., Miller P.C.H., Orson J.H. and Froud-Williams R.J., 2010. The adoption of non-inversion tillage systems in the United Kingdom and the agronomic impact on soil, crops and the environment—A review. Soil Tillage Res., **108**: 1–15.

Nivelle E., Verzeaux J., Habbib H., Kuzyakov Y., Decocq G., Roger D., Lacoux J., Duclercq J., Spicher F. and Nava-Saucedo J.-E., 2016. Functional response of soil microbial communities to tillage, cover crops and nitrogen fertilization. Appl. Soil Ecol., **108**: 147–155.

Ossola A., Hahs A.K., Nash M.A. and Livesley S.J., 2016. Habitat complexity enhances comminution and decomposition processes in urban ecosystems. *Ecosystems*.

Pisa L.W., Amaral-Rogers V., Belzunces L.P., Bonmatin J.M., Downs C.A., Goulson D., Kreutzweiser D.P., Krupke C., Liess M. and McField M., 2015. Effects of neonicotinoids and fipronil on non-target invertebrates. Environ. Sci. Pollut. Res., **22**: 68–102.

Rivers A., Mullen C., Wallace J. and Barbercheck M., 2017. Cover crop-based reduced tillage system influences Carabidae (Coleoptera) activity, diversity and trophic group during transition to organic production. Renew. Agric. Food Syst., pp.1–14.

Symondson W.O.C., Glen D.M., Erickson M.L., Liddell J.E. and Langdon C.J., 2000. Do earthworms help tosustain the slug predator Pterostichusmelanarius (Coleoptera: Carabidae) within crops? Investigations using monoclonal antibodies. Mol. Ecol., **9**: 1279–1292.

The Pesticide Detox: Towards a More Sustainable Agriculture; Pretty, J., Ed.; Earthscan: London, UK, 2005.

Van Gestel C.A.M., de Lima e Silva C., Lam T., Koekkoek J.C., Lamoree M.H. and Verweij R.A., 2017. Multigeneration toxicity of imidacloprid and thiacloprid to Folsomia candida. Ecotoxicology.

Varela M.F., Barraco M., Gili A., Taboada M.A. and Rubio G., 2017. Biomass decomposition and phosphorus release from residues of cover crops under no-tillage. Agron. J., 109, 317.

Wagg C., Bender S.F., Widmer F. and van der Heijden M.G.A., 2014. Soil biodiversity and soil community composition determine ecosystem multifunctionality. Proc. Natl. Acad. Sci., **111**: 5266–5270.

Wickings K., Grandy A.S., Reed S.C. and Cleveland C.C., 2011. Management intensity alters decomposition viabiological pathways. Biogeochemistry, **104**: 365–379.

Zhang W.J., Jiang F.B. and Ou J.F., 2011. Global pesticide consumption and pollution: With China as a focus. Proc. Int. Acad. Ecol. Environ. Sci., **1**: 125–144.