



Vision 2030



National Centre for Integrated Pest Management
(Indian Council of Agricultural Research)
New Delhi

www.ncipm.org.in



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(Indian Council of Agricultural Research)

LBS Building, IARI Campus, New Delhi 110 012

Tel: 011-25843935-36, 25840951, 25842640 Fax: 011-25841472

e-mail: ipmnet@ncipm.org.in

Website: www.ncipm.org.in

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Compilation & Production : S. Vennila
Vikas Kanwar
D.K. Garg
Naved Sabir

Technical assistance : S. Sathya Kumar
Neelam Mehta

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Foreword

The diverse challenges and constraints as growing population, increasing food, feed and fodder needs, natural resource degradation, climate change, new parasites, slow growth in farm income and new global trade regulations demand a paradigm shift in formulating and implementing the agricultural research programmes. The emerging scenario necessitates the institutions of ICAR to have perspective vision which could be translated through proactive, novel and innovative research approach based on cutting edge science. In this endeavour, all of the institutions of ICAR, have revised and prepared respective Vision-2030 documents highlighting the issues and strategies relevant for the next twenty years.

Plant protection measures are essential to increase and safeguard the farm produce both at, pre and post production stages. The excessive use of some synthetic chemical pesticides has brought forth concerns of environmental and food safety. The development and application of several Integrated Pest management technologies have proved successful and are also considered eco-friendly. However, the present estimates indicate only of 3% IPM implementation across the country. We need to examine the constraints in popularization of IPM models and adoption gaps could be bridged by making available quality products in required quantities at required place and time. The National Centre for Integrated Pest Management (NCIPM), New Delhi has made very useful research contributions and has gained visibility for introducing a paradigm shift in the field of plant protection towards IPM.

It is expected that the analytical approach and forward looking concepts presented in the '*Vision 2030*' document will prove useful for the researchers, policymakers, and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security with a human touch.



(S. Ayyappan)

11 July, 2011
New Delhi

Secretary, Department of Agricultural Research & Education (DARE)
and
Director General, Indian Council of Agricultural Research (ICAR)
Krishi Bhawan, New Delhi 110 114

Preface

At a time the national agriculture policy seeking to tap the growth potential of agriculture and attain growth rate more than 4%, agricultural production is laden with global issues of climate change, rising food prices, technological advancements and free trade. Sustainable and stable livelihood of farms and farmers require focus on *component areas* and issues of agriculture. Since biotic stresses to crop plants caused by insects, diseases, physiological disorders, weeds and rodents that limit the potential agriculture production through 18% crop yield losses, and the country's agenda of enhancing food security for the ever growing population is on the rise, plant protection across crops and regions gains importance. Our country's pesticide use of just 0.5 kg/ha remains one of the lowest in the world but skewed to few pests and crops. IPM efforts started in the early 90's with the repeated epidemics of bollworms experienced on cotton had positive socio economic impacts on cotton and on crops such as rice and vegetables. But a large number of epidemics we have experienced in the last decade across crops demand concerted efforts through a national mechanism of plant protection.

Most of all, the rapidly unfolding natural and manmade changes of the environment on crop production, in general and on plant protection, in particular, necessitates dynamic approach to basic and strategic research. Current Plant protection activities in our country have been spearheaded at the central level by the Indian Council of Agricultural Research through its Bureaus, crop based institutes, research centers and All India coordinated research and network projects (AICRP &NP) in the public sector. State Agricultural Universities complement plant protection through research and education largely supported by ICAR, and act as links to state extension machinery. The private and corporate organizations of agricultural inputs such as seeds, fertilizers and pesticides offer their R and D to be a part of plant protection. While problems of plant protection at field level are to be addressed at state level, centre has been instrumental guiding the programs of plant protection and policies. Currently more than

5000 plant protection experts are available in the country. However, a bird's eye view reveals piece meal approaches and outcomes in plant protection hindering harvesting of potential yields across crops.

National Centre for Integrated Pest Management had earlier formulated "Vision 2020" during the twentieth century followed by "Perspective Plan 2025" to address the problems and challenges, and put forth the medium and long term approaches to research. Present document takes into cognizance of the technological developments that had taken place and the emerging challenges and need of the hour to systematize and unify the research outputs and outcome with involvement of multi stakeholders in the field of plant protection.

I would like to record my sincere gratitude to Hon'ble Secretary (DARE) and Director General, (ICAR) Dr. S. Ayyappan for his visionary inspiration, Dr. Swapan Kumar Datta, Deputy DG (Crop Sciences) and Dr. T.P. Rajendran, Assistant DG (Plant Protection) for their valuable guidance in preparing this document. I am confident that NCIPM's "Vision 2030" would provide way forward for plant protectionists of the country and to sustain the crop yields of our country.



(O.M. Bambawale)

Director

National Centre for Integrated Pest Management
LBS Building, IARI, Pusa Campus, New Delhi 110 012

7th July 2011
New Delhi

Preamble

Changing crop production system spurred by changes in cropping systems, cultivation practices and climate individually and interactively, is the order of the day along with the technological advancements in the arena of agriculture. Recognition of their impacts gains focus at a time only when positive actions alone can mitigate the effects of these changes for ensuring food security and sustaining quality life. Despite the increased production levels, agricultural and horticultural produce such as food grains, pulses, oilseeds, sugar and fibre crops, fruits and vegetables, spices and cut flowers, the average yield limitations caused by insect pests and diseases remain in the range of 20–30%, maintaining the gap between actual and attainable yields.

The pest spectrum on each of the crops and methods of management over crop seasons have evolved in response to the crop production and protection changes in a given environment. Fine tuned IPM technologies for each or across pests of individual crops, encompassing combination of preventive and curative measures such as natural, biological, botanical, behavioural, cultural, genetic, mechanical and chemical options, have been validated, demonstrated and disseminated by the crop protection associates continuously through established linkage system in the country such as DPPQ&S, CIPMCs, NPPTI, ICAR institutes & SAUs, special Directorates/Boards of MoA (GOI), KVKs, FFSs and mass media. Such efforts have amply proved to be efficient to bring about farm level socio economic and environ compatible impacts. Nevertheless, unexpected onslaught at times of unpreparedness at institutional and farm levels result in enormous anxieties and loss. There is also a need of plant protection against challenges of climate change. The climate change effects on plant protection would be regionally distinct and highly heterogeneous; the isolated approaches of evolving independent solutions cannot be effective, resilient and durable. Strategic pest management with surveillance as foundation should be part and parcel of plant protection in the years to come. Such a need again requires action for a change

towards systematization through reorientation of research, education and extension interwoven by a network of stakeholders with central coordination to complement measures of food security.

Systematic surveys and surveillance supported by information technology integrated with crop and pest management advisory and effective and extensive implementation of IPM with priority settings based on crops, pests and areas were perceived for making IPM effective in the country. Legislative measures that regulate the formulation, sale and supply of toxicants of pest management addressing the label claims and licenses for sale to enhance effective use of pesticides within IPM, and model and modalities for production and financing of bio agents need strengthening. Simultaneous information flow on problems and solutions at field level monitored with the goal of higher productivity at lower cultivation costs with the combined efforts of governmental and non-governmental institutions and industries is expected to make IPM more holistic, and effective.

NCIPM's "Vision 2030" document furnishes the challenges of plant protection in the country during the present period, and the needful to be done in the coming two decades. The roadmap for achieving the sustainable growth of Indian agriculture through evolving appropriate and dynamic strategies in the component area of plant protection using state of art scientific approaches is laid for a brighter future.

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National Plant Protection Scenario

THE continuing need for enhancing food security for the ever growing population has been the country's agenda that possess around 142 million hectares of net cropped area. Integrated pest management (IPM) has been a major activity for key and regular pests of cropping systems and regions as a component of crop production in our country. However, losses due to biotic factors to field crops, under protected cultivation and storage of commodities along with transient pest problems and technological advancements at one end and need for food security and sustainability at the other end, require reorientation incorporating systematic and convergent approaches of research interwoven by a network of stakeholders. A central coordination of plant protection research is utmost essential to effectively complement measures of extension to farmers the outcome of which would be reflected in food and livelihood security of the nation.

Plant protection research in our country has been spearheaded at the central level by the Indian Council of Agricultural Research through its Bureaus, crop based institutes, research centres and All India coordinated research and network projects (AICRPs & NPs) in the public sector. State Agricultural Universities complement plant protection through research and education largely supported by ICAR, and act as links to state extension machinery. The private and corporate organisations of agricultural inputs such as seeds, fertilisers and pesticides offer their R & D to be a part of plant protection. While problems of plant protection at field level are to be addressed at state level, the Centre has been instrumental guiding the programs of plant protection and policies. Currently more than 5000 plant protection experts are available in the country. However, a bird's eye view reveals piece meal approaches and outcomes in plant protection research and lack of consolidation to effectively and efficiently derive the effect of plant protection recommendations across crops and regions of the nation so far or to feel comfortable to continue with the same type and level of plant protection approaches.

The recent discussions during a brainstorming meeting on “Making IPM Effective in India” held under the aegis of National Academy of Agricultural Sciences (NAAS) in association with Indian Council of Agricultural Research (ICAR) on 29th September 2010 covered wide range of researchable issues of IPM right from the assessment of losses caused by pests for prioritising research to revalidation of IPM technologies before dissemination to farmers. Anticipatory research for alien invasive pests, pest risk analysis and IPM research for emerging problems on transgenic crops, organic farming and protected cultivation were stressed. Focus on nanotechnology, development of weather based degree models and strengthening research on restorative ecology towards fabricating IPM solutions were put forth. Although there is voluminous plant protection research reflected in publications, the returns to research investments towards benefitting farmers are meager requiring a soul search of research approach to plant protection.

Evolution and Progress of IPM Research

IPM is a knowledge-based, farmer driven management approach seeking to maintain pests below economically damaging levels as a major component of ecologically viable and sustainable agriculture. An urgent need for IPM was felt with the consequences of overuse of synthetic pyrethroids on cotton cultivation; culminating into a large-scale epidemic of *Helicoverpa armigera* during 1987 accompanied by resurgence of whiteflies and in their wake the farmers' suicides. Cotton with only 5% area consumed > 50% pesticides and yet the problem evaded solution. At about this time in 1988, ICAR established NCIPM. After the initial teething troubles, NCIPM took up the challenge of developing IPM approach for rainfed cotton, by first synthesizing and evaluating various IPM modules at small scales (1995-97) and then going in for a holistic, community based village level approach at Ashta in Nanded district of Maharashtra from 1998 onwards. The



Emerging pest problems of 21st century

major impetus for this had been another cyclic national episode of *H. armigera* in 1997. Popularly known as the “Ashta Model”, the IPM approach validated over 180 ha during 1998 – 2001 established the sustainability of IPM as it successfully faced another major *H. armigera* epidemic in 2001.

The IPM research and adoption intensified steadily through various strategic and applied research approaches through the first decade of the 21st century. Regular surveys across the nation have not only brought forth the emerging problems such as white grub in sugarcane of western Uttar Pradesh, papaya mealybug in Tamil Nadu, stem canker of potato in Uttar Pradesh and hot spots of *Sclerotinia* stem rot of mustard in Rajasthan but also aided in taking immediate steps to contain the spread or manage them effectively.

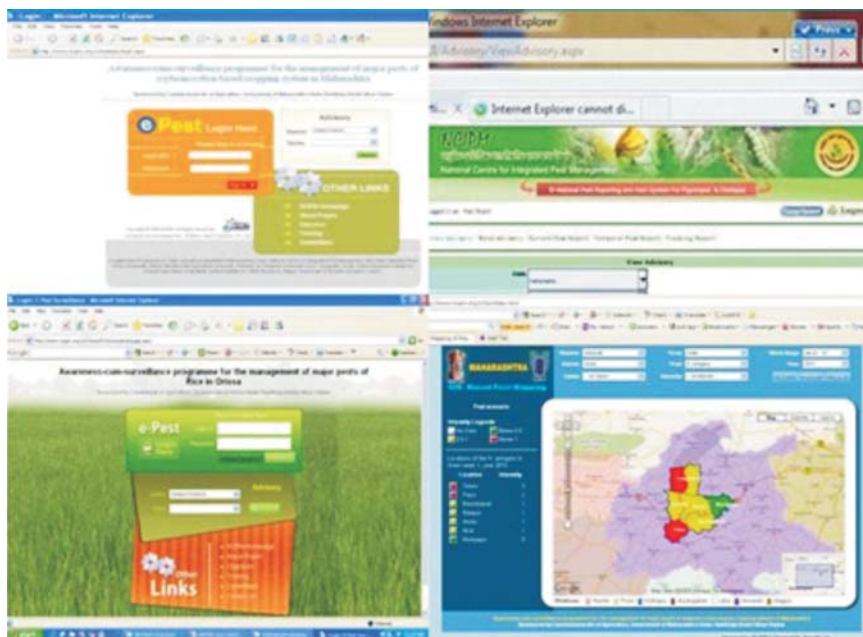
Each of the crop -commodity - based research institutes evolving IPM strategies and their multi location testing through AICRP centres although brought out relevant technologies for recommendation by the SAUs, the variability of geographical, agro climatic, crop production and protection conditions and lack of unification with policies and input availability always reduced the efficacy of IPM. Validation and popularization of IPM among crops of rice, pulses, sugarcane, oilseeds and vegetables at famers’ fields have been done by NCIPM across different parts of the country and have paid dividends in terms of profit, reduction in pesticide use along with awareness among farmers. The highlight of the centre during the last decade has been the integrated surveillance cum awareness through national information



IPM validation in different crops

networks for large scale real time pest monitoring and management advisory. Positioning of pest scouts, pest monitors and data entry operators at the village, taluka and district levels, along with provision of training for pest diagnosis, data collection using standardized sampling methods in prescribed formats from geo referenced farms, and mobile computer systems incorporated with customized software for data upload and advisory download marks an unaccomplished task of crop protection to take off in the 2009 season for four crops across 28 districts of Maharashtra.

As on date, validated IPM for agricultural and horticultural crops exists but is limited to local levels. Area wide implementation of IPM came to a reality through execution of massive awareness cum monitoring program when there was outbreak of an invasive mealybug in Northern states on cotton during 2007 and 08 seasons. The success of the approach to pest management transformed the face of IPM where integration reached higher levels with co-ordination of researchers of crop based institutes of ICAR, SAUs and State Department of Agriculture of Maharashtra initially to start with followed by Orissa in respect of soybean-cotton and rice, respectively. The



Area wide e-pest surveillance across crops

combination of manpower, information technology and awareness trainings and campaigns provided cutting edge to the field level implementation of IPM resulting in farmers' welfare. Envisioning IPM at this day and time is of the order of web enabled on-line monitoring, GIS mapping depicting hot spots, issue of pest management advisories on-line and dissemination through SMSes. The Accelerated Pulse Production Program took up field level demonstrations of holistic chickpea and pigeonpea production across states of Andhra Pradesh, Madhya Pradesh, Maharashtra, Karnataka and Uttar Pradesh under the NFSM including the supply of critical inputs. E- pest surveillance based area wide plant protection is the emerging way of IPM in crop production in the current decade. Recent IPM implementation efforts in area-wide IPM enhanced the pulse production of the country. The centre has also been granted two patents *viz.*, egg cleaning device for collecting and cleaning *Corcyra* eggs and aerial insect trap besides filing ten other patents. An amount of six lakhs rupees has been generated as revenue through commercialization of eight technologies.

NCIPM–An Apex Centre for Plant Protection Research under NARS

THE Indian Council of Agricultural Research established the National Centre for Integrated Pest Management (NCIPM) on 12th February, 1988 during VII Five Year Plan at Faridabad (Haryana) for development and promotion of adoptable IPM technologies for the management of major pests of national importance across crops. For the period between 1988 and 1993, the centre had the unit of All India Coordinated Research Project on Biological Control of Bengaluru under NCIPM. In January 1995, NCIPM was shifted to Lal Bahadur Shastri Centre for Advanced Research in Plant Protection and Biotechnology, IARI Campus, New Delhi. Another shift of the centre to an independent and earmarked location at Mehrauli during XII plan is on the agenda.

Over the 23 years of existence, the functional wheel of NCIPM whirled itself as robust fulcrum with arms of connected and coordinated plant protection activities across regions, disciplines, public and private agencies across the country. Journey so far has been relentless and incredible, crossing many milestones in its path on a large scale that has shifted IPM paradigm from individual insect pest to area wide pest management, at research as well as farm levels. While earlier period of the institution brought out an IPM movement in the country through validation cum demonstration of IPM



MANDATE

- To develop and promote IPM technologies for major crops to sustain higher crop yields with minimum ecological implications.
- To develop centralized information and data base on all aspects of pest management and to advise on related national priorities and pest-management policies.
- To establish linkages and collaborative programmes with other national and international institutes in the area of IPM.
- To extend technical consultancies

technologies under cereals, pulses, oilseeds, fibre, vegetable and fruit crops, recent years embarked on intensive integration of information technological tool into the linkages of research, developmental and extension arena with long term perspective of efficient functioning of pest management component in all crop production systems of the nation.

NCIPM 2030

NCIPM has been making strides in addressing the current problems of various crop production systems maintaining the socio economic and ecological concerns of the farming community across states of the country. The activities of NCIPM extend across and beyond different disciplines and agencies to establish partnership with SAU's, Government agencies, industries, NGO's and farmers. Through its partnerships, NCIPM plans and conducts eco-friendly IPM research and development programmes essentially required for sustainable agriculture. With concurrent development of knowledge base on all areas of crop protection and by strengthening the linkages with stakeholders connected to pest management, promotion of IPM in our country has obtained a major fillip in the current decade.

The Centre has made significant beginning in achieving the goals of IPM and made innovative and pragmatic efforts to develop computer based programmes for storage and retrieval of information on different aspects of IPM. The area wide IPM implementation currently underway with field level surveillance and the real time pest surveillance based advisory for states of Maharashtra and Orissa bear testimony of integrating hard and software tools of information technology along with people and places with "Farmer First" principle of ICAR. Investigations to document the changing pest scenario *vis a vis* climatic change, describing distributions of pest across crops and for a crop across pests over states of the country would be an enriching approach for evolving a national pest management policy. The Centre envisions enlargement of IPM implementation across the nation through network/collaborative pest surveillance and advisory programs for major crops for a wider and speedy realization of effects of IPM.

Vision

To bring in a paradigm shift in IPM through efficient co-ordination of plant protection programmes of the country with the objective of sustaining food production through minimization of crop losses while enhancing agricultural production systems

Mission

Fulfill the holism of IPM through enhancement of knowledge base *vis a vis* synthesis, validation and promotion of effective, eco friendly and socio economically viable pest management technologies as a component of sustainable agriculture.

Focus

The research strategies of plant protection always accounted the environmental protection within the context of sustainable use of plant protection products in relation to the pest problems for long. IPM is always at the crossroads with rapid shifts in the composition of the crop cultivars, utilization of the transgenic technology and the advanced products of pest management. Since, tactical integration dominated IPM research, development and implementation over the last two decades *vis a vis* supporting activities of extension could not achieve holism due to lack of comprehensive and centrally coordinated unified plant protection bringing all stakeholders to a common platform is the need of the hour. Since IPM has enormous accommodative power in terms of goals and objectives, development of tools of plant protection right from sampling procedures, accounting tolerance mechanism of host plant resistance and considering the role of native natural enemies before evolving economic threshold levels for curative action using insecticides is needed. Applied systems research at ecosystem level accounting for interactions of important system variables *viz.*, crop, insect pests, natural enemies, cropping practices and patterns is a necessity to improve decision making on profitable and sustainable IPM in the era of information technology and precision farming. This requires priority setting of researchable and policy issues and functional reorientation of institutions involved in plant protection. While the principles and practices of plant protection remain within the same framework, the vision to systematize plant protection research requires the following action points towards consolidation of plant protection research across crops and agro climatic regions. The key areas for focus at national level are:

- Strengthen the Centre's infrastructure and human resource capacity for consolidation of plant protection research and development in the country.
- Establishment of national networks through 'AICRP on IPM of crops' for reorientation of plant protection across crops,

pests and agro climatic regions for evolving coherent recommendations on planning research and implementing pest management practices in relation to production, protection and climate change scenarios..

- Establish comprehensive centralized data base on plant protection activities, projects of plant protection and manpower and existing recommendations of plant protection.
- Enhance role of centre-state and public - private interface in plant protection research.
- Identify vital gaps of research, recommendation and impact of IPM at all levels.
- Demonstrate the ease and success of convergence for area wide implementation of IPM using tools of information technology.
- Formulate unified plant protection guidelines to facilitate proper and regulated use of pesticides and biologicals including transgenic products.

Consolidation of Plant Protection

NCIPM is the only national level agency for interfacing among different stakeholders of plant protection, and there is an urgent need to reorient our perspectives and plan for foreseeable future in a harmonized way, to avoid fragmentation of efforts. Therefore, the major goal of NCIPM would be to consolidate the gains, and further improve productivity and quality with sizable reduction in cost of cultivation with the aim of improving the socio-economic standards of farming community and quality of life of the general public through reduction in pesticide residues in the food chain and the environment. A target for covering at least 30% of the arable area under IPM is set for 2030 through a nation-wide network of the stakeholders on major crops including cotton, rice, pulses, oilseeds, sugarcane, horticultural crops, and organic/protected export oriented cultivation. Education and training will have a prime place in promotion of IPM especially now when we have access to powerful electronic tools. IPM systems suited to the diversity of agro-ecosystems, climate, and uneven resourcefulness of the farmers are the needs and to achieve these, the vision is at first to consolidate the national plant protection at research level through a policy with provision of a matching grant. Salient areas justifying their need for attention are given below:

Strengthening strategic research on plant protection

Crop centered research right from biology to management for individual pests could be useful only for analysis of scenario and management at local scale. The nodal centers of the current AICRPs can present pest scenario across regions for a crop but it does not account the cropping systems of the region or other hosts of common pests. Understanding the ecology of the pests in terms of source of origin/entry, distribution/spread pattern, zone of optimal development and status over space and time across locations, and overall scenario across the country needs effective functioning of national networks for pest groups across crops of different agro climatic regions. With NCIPM as 'hub' and AICRP on crops as 'spokes' the plant protection

in general and IPM in particular of the country can regulate crop protection of the nation for betterment of crop production. Central co-ordination of plant protection also would make the legal measures against alien invasive species and quarantine support for import and export of plant materials and commodities most effective.

Measurement of stage specific crop response to single and multiple species through experiments under controlled and manipulative conditions would quantify the interactions between and among species. Converting of the currently adopted pest population density and damage estimate methods into a novel and simple crop growth monitoring for making pest management decisions would make IPM effective. Since putting IPM into practice should be in the mode of “grow with the crop” during the season, the research and development recommendation should follow similar guidelines. Use of biological products has increased scope in IPM but their variability, label claims and ineffective use makes their field level efficacy unclear. Discrepancies of pesticide use *viz.*, difference in efficacy due to different grades of solvents and adjuvants during formulation, imperfect knowledge on the amount of spray fluid and spraying technology such as output of nozzles, pressure, swath width, overlap and sprayer calibrations are often the cause of pest control failures. The use of Environmental Impact Quotient accounting toxicology data and chemical parameter information to calculate the risk to farm workers, consumers and environmental organisms as a means to assess the environmental risk of different pesticides should be considered for use within IPM.

Centralised data base on pestilence and plant protection research

Plant protection research range from activities associated with identity of pests and natural enemies (biosystematics), pest risk analysis (for alien species), formulation of scientifically sound and representative sampling methodologies, diagnostics, crop and pest based survey and surveillance, crop loss assessment, bio ecological studies, establishing, validating pest management options involving various tools to impact assessment at user level. Although approaches may be wide and variable, the outcomes with similarities or variability across crops and pests over space towards plant protection should be known individually and collectively. Although organised activities

per se for crops, region or researcher may be underway across the country, no details are available at a single place that can be used for strategizing and policy making towards plant protection research.

Database of projects of plant protection and man power

Problems of plant protection are addressed as per the need of the hour at field level largely deriving knowledge from various scientific areas/ fields involving basic, strategic and applied research. However, no planner or policy maker nor research managers visioning for future could get a quantified idea to steer the national plant protection. The centralised pooling would generate an opportunity to build human capacity in the required area of plant protection, unify people of similar interests, assist in prioritising allocation of resources in terms of not only man power but also the research area of plant protection and ultimately to attain a focussed research agenda of plant protection.

Data base on existing recommendations of plant protection

Plant protection recommendations are state governed with research back up from central as well as state institutions of plant protection. No quantified estimates are available on the integration of research outputs into the package of practices for a region/ state. This is basically due to the compartmentalized approach of plant protection research as well as the validations carried out. The strong basic validated research outputs/protocols of ICAR for an effective and efficient plant protection are used meagerly by the states. Applied research outputs of ICAR, however strong they are, their adoption becomes localized and short lived at field level. There is need for harmonization of testing research outputs on a regional/crop/pest basis across the nation.

Role of Centre-State and Public–Private interface in plant protection research

Centre-State and Public–Private interface of plant protection is highly interdependent and a pre requisite for effective plant protection in the country. There is need for mutual consensus on scientific grounds towards evolving plant protection technologies. There is need to reorient current plant protection programs at research and development into a holistic mode through development of plant health based pest management technologies with natural resource based host plant resistance and farming practices as foundation to concur

with cropping and farming systems. There are overlapping and exclusive issues/ responsibilities of plant protection for the stakeholders, be it central/state/public/private as the goals are different. Since research and developmental activities cannot be weighed alone considering the purpose of plant protection in the larger interest of the society, there need to be a well - planned and delineated role play for each of the stakeholder resulting in unification of plant protection recommendations and delivery systems.

Popularization of unified plant protection guidelines

Principle of “Distraction through attraction for adoption” is no exception for plant protection. The assemblage of research results in books/reprints etc., add only glory to the academicians and the need is to convert them to usable and understandable formats.

Strategy and Framework

BROADER strategic areas to attain the vision and goals of consolidation of plant protection in the country have been identified and detailed for enhancing the competence and utility of plant protection resources along the focus areas of NCIPM (also see *Annexure D*).

Building up infrastructure and human resource capacity for consolidation of plant protection research and development

- Establishing the state of art national hub for plant protection including the ‘AICRP on IPM of crops’ at the newly developing location of the Centre at a quicker pace
- Empowering the human resource in the areas of advanced plant protection cutting across disciplines, crops and institutions through convergence programmes across and outside the nation
- Strengthening linkages among NBAII, NBAIM, NCIPM, AICRP, DWSR and crop protection divisions of all crop and natural resource management institutes to evolve unified and convergent IPM recommendations
- Supporting the national curricula development and experiential learning facilities for IPM in particular and crop protection in general

Development and steering of comprehensive centralized data base on plant protection activities, projects of plant protection and man power and existing recommendations of plant protection

- Steering linkages of bio systematic service, pest risk analysis and unifying sampling methodologies for pests of crops.
- Establishing crop and pest based survey and surveillance based on online monitoring integrating ICT & GIS through established networks across the country involving crop based, natural resource and crop protection centers and accelerating advisory dissemination

- Serving as centre of co - ordination for crop protection related ICAR, SAUs, AICRPS and private institutions - for record keeping, analyses and for envisaging needful policies and actions in relation to production, protection and climate change scenarios
- Development of knowledge base of the national plant protection projects and personnel for effective plant protection planning for research and development on a macro scale and on long term basis

Enhanced role of centre-state and public - private interface in plant protection research and development by promoting and streamlining the harmonious technology management system

- Improvement of plant protection technology delivery systems through institutionalizing plant health clinics through multi stakeholders
- Strengthening the legal pillar of plant protection tools for quality preservation right from pest resistant cultivars, monitoring tools and products of pest management ranging from pesticides and sprayers to hard and softwares
- Provision of guidelines for a well planned and delineated role play for each of the stakeholder involved in research and development
- Development of exclusive electronic media and multilingual body for dissemination of research outcome and plant protection advisory

Advancing plant protection implementation of the country to higher integration levels through establishment of synergies across places and personnel through well planned policy framework

- Identification of vital gaps of research, recommendation and impact of IPM at all levels
- Demonstration of the ease and success of convergence of plant protection for area wide implementation of IPM using tools of information technology and by formulation of unified plant protection guidelines

Epilogue

NCIPM is duty-bound to place in practice the technology led plant protection in the country to meet the increasing needs of food production with environmental safety. The changing lifestyle, environmental and trade requirements besides changing formats of resource availability require the approach to plant protection to be dynamic. Although the concept of IPM in vogue has acclaimed theoretical merits largely, realization of its benefits need breaking boundaries and enlarging the platform that there are mutual benefits to all regions and life forms including mankind. Changing plant protection approach is the order of the day in the face crunch of labour shortage at farm level to the emerging consumer demands of organic products not to be short sighted of the man made technological advancements at one end to nature's outplay leading to unexpected epidemics. While plant protection research outputs are churned by central government, the package of practices for pest management recommendation is a state subject. Therefore, NCIPM strives to enlarge the platform of plant protection research, extension and education simultaneously to harness the benefits early enough. A comprehensive policy environment including inputs from all the involved stakeholders along the delivery line would be promoted.: Systematic surveys and surveillance supported by information technology integrated with crop and pest management advisory and effective and extensive (not intensive) screening of tools of IPM with focus on existing pest problems would lead to effective and easy IPM implementation. Legislative measures that regulate the formulation, sale and supply of toxicants of pest management addressing the label claims and licenses for sale would enhance effective use of pesticides within IPM. Simultaneous information flow on problems and solutions at field level monitored with the goal of higher productivity at lower cultivation costs with the combined efforts of governmental and non governmental institutions and industries would make plant protection effective and holistic.

Annexure I: Strategic Framework

Goal	Approach	Performance measure
Increasing food production through reduction of pest loss	<p>Characterization of changing economic loss due to pests</p> <p>Identification of pest hot spots and pest free zones</p> <p>Adoption of preventive but environmentally friendly plant protection technologies</p>	Improved crop yields without pest outbreaks and pesticide residue free food products
Enhancing the structure and function of national plant protection research and development	<p>Unification of plant protection activities to a common platform</p> <p>Evolving a national mechanism of plant protection governance</p> <p>Endorsement of plant protection technologies for recommendation</p>	Increased efficiency of plant protection research outcomes and their regulated use
Addressing plant protection needs of crops and regions on a neutral scale	<p>Documentation of changing scenarios of biodiversity at ecosystem, cropping, farming and regional levels</p> <p>Identification of robust relations of pests with environmental changes (both biotic and abiotic)</p>	Conservation and increased efficacy of plant protection research resources at national level
Establishment of information repository for central co-ordination and support on plant protection	Networking protection agencies in a "hub and spoke" model for pest management followed by market linkage for crop produce	Establishing strong and mandatory linkages with public and private agencies and increased profit to farmer

Goal	Approach	Performance measure
Establish a simple but robust mechanism for area wide pest management	Web enabled surveillance for crops and regions with background research support and feed back Empowerment of developmental and private agencies for scientific pest management	Precise and timely practices of pest management at farm level leading to reduced yield loss
Human resource development for plant protection research and development	Reoriented and experiential learning set up for plant protection educationExposure trainings for plant protection research in areas of understanding effects of climate change, modeling and area wide pest management	Advanced research in plant protection and better research outcomes
Accelerated and quality pest advisory for increased adoption	Development of electronic tools and products for assessment of pest damage at field levelMultilingual content development for pest management advisories and dissemination through mass media	Increased outreach of scientific plant protection extension

Annexure II: Abbreviations

AICRP &NP	All India Coordinated Research and Network Projects
CIPMC	Central Integrated Pest Management Centre
DARE	Department of Agricultural Research and Education
DPPQ &S	Department of Plant Protection, Quarantine and Storage
GIS	Geographic Information System
ICAR	Indian Council of Agricultural Research
ICT	Information and Communications Technology
IPM	Integrated Pest Management
NAAS	National Academy of Agricultural Sciences
NARS	National Agricultural Research System
NBAII	National Bureau of Agriculturally Important Insects
NBAIM	National Bureau of Agriculturally Important Microorganisms
NCIPM	National Centre for Integrated Pest Management
NFSM	National Food Security Mission
NPPTI	National Plant Protection Training Institute
SAU	State Agricultural University

