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PLANT CLINIC TOWARDS PLANT HEALTH AND FOOD SECURITY

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ABSTRACT

Ever-growing population, climatic changes and unprecedented losses due to pests and diseases pose serious threat to food security. Precisely food security implies availability of adequate food to everyone in all times to come. Food and Agriculture Organization of United Nations (FAO) defines “food security” as a state of affairs where all people at all times have access to safe and nutritious food to maintain healthy and active life. Food is one of the three basic needs of man, without which his survival is at stake. Plants constitute the basic source of food and as such, plant health management is crucial to food security, which is jeopardized due to unprecedented threat by large number of insect-pests, diseases, weeds and several edaphic and environmental stresses. Srivastava (2008, 2009) has very well highlighted the importance of plant health security through phytomedicines/pesticides and plant health clinic in order to prevent 40 per cent losses occurring from field to fork globally. Due to unabated rise in population, reduction in arable land will be an ongoing process, hence we may have to strive hard to grow more food from limited land employing innovative strategies and more importantly adopting multipronged initiative and timely diagnostic and management strategies from plant health clinic to combat attack from pests and environmental stress, manage plant health mitigate losses.

Keywords: Plant health clinic, climate change, food security, pest monitoring, plant health camp.

PLANT HEALTH MANAGEMENT

Managing plant health is vital to sustained food production and ensuring food security. Healthy plants not only guarantee bountiful harvest but ensure nutritional essence as well. Plants are to be nurtured like a child from the very beginning to prevent invasion from biotic and abiotic agents employing integrated crop management. Several tools have been in practice to provide utmost protection to plants which comprise use of pesticides – chemical and or biological, integrated nutrient management (INM), integrated pest management (IPM)/good plant protection practices, host resistance, biotechnology etc.

HOST RESISTANCE

Host resistance is one of the most important means of fighting against plant diseases/pests and therefore greater reliance should be given to host resistance in agrarian system, rather than resorting to use of pesticides, which poses health hazard problem to

applicator, consumer and pollute environment and affect biodiversity by their impact on ecosystem. It is therefore desirable to use as far as possible resistant or tolerant cultivars in consultation with agriculture department or agricultural university.

PROTECTION THROUGH PESTICIDES

Plant diseases and other pests cause 40 percent reduction in yield worldwide (Oerke *et al.*, 1994). As per recent estimates, India is losing annually INR 1, 40, 000 crores due to pests and diseases (Kumarsami, 2008). Pesticides play an important role in plant protection. Pesticides are the basic tools for managing plant pests. Man in his endeavor to provide protection to plants and ensure food availability to ever growing population has greatly depended on pesticides, which have been used since 19th century. I earnestly believe that pesticide would still continue to be used as the most important arsenals of controlling plant pests to ensure food security. However, their use has to be made judiciously, which unfortunately is not, and their reckless and indiscriminate use has created more problems. Pesticides came under serious criticism with the

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publication of 'Silent Spring' in 1962 by Rachel Carson (1962), who apprehended threat to man and environment. Frank Graham (1970) too expressed similar views on pesticides in his book 'Since Silent Spring'. Another publication, 'Silent Spring Revisited' by Marco *et al.* (1987) also corroborates the concerns of Rachel Carson. Today indiscriminate use of pesticides has undoubtedly adversely affected ecological balance resulting in pest resurgence, aggravation of minor pests, pesticide resistance, and environmental pollution and more importantly their residues in food and feed posing serious health hazards to man and animal. The use of endosulfan in Kerala has created furor due to unprecedented health hazards leading to neurological problem in children which led to ban of the pesticide in Kerala. Now the big question before us is – whether pesticides are really responsible for hazards or its man's folly which has created these problems? Lets probe and see what best can be done for the society.

In India pesticide use, which is approx 500 g/hectare is too small as compared to those in developed nations such as UK, USA, China and Japan and therefore I leave it to you think and ponder whether such low amount can pose threat to environment. In India 229 pesticide are registered as against 5487 in China. Amongst registered pesticides in India, fungicides are hardly 39 in number. Further amongst different classes of pesticides, fungicides in India are consumed around 10 per cent of the total pesticides while insecticide and herbicide consumption is many folds higher, and as such, the blame that squarely goes to pesticides cannot be assigned to fungicides. In fact most of the hazards faced by the society are due to indiscriminate use of insecticides. In other Asian countries too use of insecticides is going beyond 60 per cent of the total pesticides, which is not the situation in western world, and therefore a course correction is required. Pesticides are poisonous entities and hence need to be used with utmost care. LD₅₀ values are indicative of their toxicity, which for common man is reflected by colored triangles – green denoting less toxic while red, is extremely toxic. Pesticides most frequently responsible for hazards are organochlorine, organophosphates and carbamates insecticides. Fungicides, conversely do not pose much hazards except organo-mercurials. It may, however, be clearly understood that there are many commodities including beverages and drugs whose LD₅₀ is comparable with pesticides. Should we then blame pesticides for

hazards or users for reckless use? However, presence of pesticide residues in agricultural produce – particularly fruits and vegetables, milk and eggs has become a matter of concern. There is sufficient evidence that it is a widespread phenomenon and that too with insecticides but again a man-made problem for his selfish gain ignoring the principle of 'safe use of pesticides' and therefore there is a need to sensitize growers and bring a change in their attitude towards mankind and have to take a balanced approach and in any case, total reliance on pesticides has to be abandoned. Simultaneously pesticide industry has to take cognizance of widespread hazards of certain pesticides in certain areas, and therefore such pesticides need not be marketed/promoted in such areas, and relief needs to be provided and use of such deadly pesticides should be totally stopped in such areas.

OPTION AHEAD TO MITIGATE THREATS FROM PESTICIDES

While pesticides play a crucial role in protecting plants from ravages of insect-pests, diseases and weeds, their indiscriminate use has undoubtedly been responsible for health hazards to man and animal, environmental pollution with residues accumulating in atmosphere, soil and water etc, disruption of ecosystem creating imbalance between pest and antagonist, trigger resistance development, and socio-economic aspect. It must be, however, remembered that pesticides are aid to agriculture and not poison. Srivastava (1999) has rightly said that 'pesticides are necessary evil in plant protection', and therefore they cannot be kept at bay. Pesticide use in India and elsewhere has supported food security. In fact most of the hazards enunciated earlier arose due to poor knowledge, misuse and abuse of pesticides. It is therefore essential to sensitize users with various aspects with pesticide storage and use Srivastava (1999). Plant protection advisors therefore require organizing frequently pesticide safety campaign from time to time as was initiated by Haryana Agricultural University in early 1980s. Unsatisfactory control of many pests and diseases is not exclusively due to resistance development but also because of substandard ad spurious pesticides and therefore plant protection personnel entrusted with quality control are required to exercise utter vigil. With the development of 4th generation or recent generation pesticides, pest control has become more effective with least impact on environment. The pest control advisors are therefore

required to have in-depth knowledge about pesticides as pesticides are the basic tools in the hand of professionals, as pesticides can only offer respite during pest outbreak.

INTEGRATED PEST MANAGEMENT (IPM)

In order to minimize increasing hazards due to pesticides and to prevent ecological disruption and making pest control cost-effective, ecologically sound, and socially acceptable, a balance approach can be adopted, by integrating pesticides with other measures of control – the IPM approach or what in common parlance is known as Holistic approach. This has been suitably projected by van Embden and Peakall (1996) in their book 'Beyond Silent Spring'. The last chapter of Silent Spring, 'The other road' describes Rachel Carson's view, which modestly hints toward IPM, although the concept of IPM was first proposed by Stern *et al.* (1959) but IPM caught worldwide attention only after UNCED at Rio de Janeiro in June, 1992. IPM encourages the most compatible and ecologically sound combination of available pest suppression techniques to keep pest population below economically damaging levels. Integrated pest management is therefore is an innovative paradigm which offers best pest control strategy and simultaneously cutting down pesticide usage appreciably. IPM, contrary to popular belief, is not doing away with pesticides altogether, but in practice it has become synonymous with biological control. This is only because great reliance has been placed on natural enemies in IPM. Since modern pesticides are more environment-friendly it would be imperative to consider inclusion of pesticides along with resistant varieties, and bio-control agents to improve IPM package. To minimize the hazards of pesticides there is growing awareness to reduce the consumption of pesticides worldwide. In India initiatives have been taken by ICAR, SAUs, and National Institute of Plant Health Management, GOI, Hyderabad, which has also initiated a Plant Health News Letter to strengthen IPM. The IPMnet NEWS from Oregon State University, USA provides worldwide development on IPM. Germany in its effort to assist growers to reduce pesticide use over the oncoming years has refined the theoretical concept of necessary minimum (NM), which defines a level of pesticide above which further use is unnecessary. The term arises from the German definition of IPM as spelled out in the Plant Protection Act, 2012. The Act states "IPM" is a combination of measures-with priority consideration of

biological and biotechnical measures, resistant cultivars, cropping and cultural control measures—where the use of chemical plant protection products is restricted to the necessary minimum. Undoubtedly IPM is receiving worldwide attention and shall certainly help in protecting environment from all round hazards from pesticides by its bare minimum use. It would not be out of place to mention that the European Union, Member States shall ensure by 1 January 2014, adoption of IPM for sustainable agricultural production.

BIOTECHNOLOGY

It is aimed at developing transgenic or genetically modified crops (GM) could be another route by which pesticide usage could considerably be reduced and simultaneously realizing higher yield. India commercialized its first transgenic crop, Bt cotton in March 2002 and now Bt cotton has completed its 10 years journey with remarkable success. Bt cotton covers 90 per cent of India's cotton growing area. In 2011-12, the productivity of Bt cotton is 485 kg lint per ha, with 560 kg lint per ha in 2007. With Bt, India became a global exporter of cotton; since 2005, exports have been between 600,000-1.5 million tons each year as per Central Institute for Cotton Research data. The Biotech industry credits the technology for bumper harvest, though farmers and activists blame the seed for failing the crops and debt traps. In fact biotech could be considered crucial to second green revolution since Bt crops have ability to fight against pests and require little or no pesticides. Bt cotton is the only transgenic crop currently approved for cultivation in India. Bt brinjal is under moratorium for commercial release. However, there are valid health and environment concerns regarding adoption of GM crops. It is for this reason that adequate safeguards need to be in place to ensure consumer safety. Only 4-5 countries have introduced Bt food, including the US, Canada and Brazil. Needless to mention that European Union (EU) has not allowed Bt food so far, and therefore many lay more emphasis on organic food rather than GM food.

ORGANIC FARMING

It is another option to cut down pesticide use. Fashioned by environmentalists, organic farming is aimed at producing commodities without using pesticides and other agrochemicals. Although produce with organic certificates may fetch higher prices it cannot feed ever-increasing population and more so bearing the higher cost in times of inflation. Further reliance on

certification needs reassurance. It appears more to be an illusion. It may, however, be practiced in western world where population has stabilized and their kitty may allow them to bear the higher cost, but certainly not India for obvious reasons (Srivastava, 2005). However, incentives of higher return has motivated farmers in producing organic food – especially in and around metros, where organic food has become the buzz word when it comes to healthy diet free from pesticide residues. Incidentally, in the European Union, Member States shall ensure by 1 January 2014, adoption of IPM for sustainable agricultural production.

One should not have blinkered vision towards pesticides, and it must be clearly understood that in the event of outbreak of diseases and pests, pesticides can only offer respite, and therefore their importance cannot be ruled out. What is important is the rational use of pesticides with right intention keeping in view mankind, environment and eco-system. Meanwhile repeated use of systemic insecticides and fungicides has to be avoided, and use of novel fungicides, bio-pesticides need to be promoted. Simultaneously the government has to exercise implementation of Central Insecticide Act, 1967 in all earnest.

PANT HEALTH CLINIC

Failure in timely diagnosis of diseases and other pests has often been responsible for devastating losses. Reducing crop losses by keeping pests at bay is crucial to food security. Plant clinic is an innovative paradigm which plays a vital role in assuring food security and ushering prosperity by providing timely diagnosis and rendering necessary advice to the growers, gardeners and other stakeholders for managing pest problem.

In USA and Canada, plant clinics are operating with the Department of Plant Pathology of various state universities and State Department of Agriculture. Under CABI's Global Plant Clinic Program (now Plantwise initiative since 2010), plant clinics are operating in many Afro-Asian and Latin American countries, which do not have their physical identity and are held in market places (Boa, 2010) and are referred to as plant clinic or walk-in-clinics or community-based clinic or mobile clinic, which may be considered as 'plant health camps', on the analogy medical health camps organized by hospitals or physicians in India. In true sense mobile clinic implies, a mobile clinic van with basic tools, public address system, relevant films with experts/plant doctors rushing to affected or desired area, beyond clinic

premises to diagnose the problem in the affected area and offer solution to suppress or manage the problem.

Plant clinics operate as unit of Plant Pathology Departments and or Extension Education Directorate of the state agricultural universities. Under National Horticulture Mission of Department of Agriculture and Cooperation, Government of India, more plant clinics are coming up in public and private sector. Unfortunately we do not have organized plant clinic or polyclinic with its independent identity like the ones for humans and animals. The issue has been raised by Srivastava (1999, 2003, 2005a,b, 2008a) at different platform in India and abroad and more vehemently in 9th ICPP at Italy (Srivastava, 2008b) while voicing for emergence of well organised clinic worldwide. In order to ensure unprecedented health management to plants and consequently food security we have to make all out efforts to go for well organized plant health clinics in urban areas and more importantly at grass root level in rural areas to provide unstinted plant health care like the primary healthcare center for humans, and veterinary clinic for cattle.

Plant clinics are all about plant health. Though the major role of plant clinic lies in diagnostics and advisory, the activities of plant clinic extend beyond plant clinic, with emphasis on extension, working more closely with farmers and organizations involved in promoting food production. Srivastava (2005, 2008, 2009) has redefined the role of plant clinics beyond diagnostics and advisory. These are : training and teaching to students; training farmers and extension personnel on field diagnosis of pests and diseases, producing fleet of plant doctors, keeping a vigil on bio-terrorism/invasive pathogen, promoting integrated pest management, monitoring pest/diseases distribution, their outbreak, issuing pest alerts, organising plant health camps for creating awareness regarding likely appearance of pests/diseases, strengthening mobile clinic approach during disease/pest outbreak, reaching farmers through internet, mobile leaflets, hand outs, hand bills etc. Collaboration of development agencies/input dealers and media may be sought in achieving the goal, on matters pertaining to plant health and refining advisory role so as to render better services to growers who produce food for us.

PLANT CLINIC WITH DIFFERENCE – A FARMER-CENTRIC PLANT CLINIC

An ideal clinic is aimed at improving people's lives by

providing information and applying scientific expertise to solve problems in agriculture and saving their crops from ravages of pests and diseases through timely diagnosis and remedial measures, consequently improving crop productivity and their well-being. Plant health and agricultural sustainability are our major concern. Such clinics should be located in easily accessible area, with a prominent name in regional language/Hindi/Urdu and English and a green cross + signifying a plant hospital, with buzz word “Plant Health is Our Concern” and its equivalent in local language.

To address growing complexity in pest-scenario, more so due to changing climate, creating more well-organized multispecialty clinics with independent physical identity, better infrastructure and resources, redefined role aimed at total plant-health, is imperative to boost food security. Precisely, clinic should be farmer-centric, with distinct identity, welcome-counter with overhead electronic-display of scrolling-text showing relevant message on plant-health, waiting-cum-exhibition-hall with exhibits and colored signage/blow-ups of diseases/pests, café/toilet, well-equipped library, agro-pharmacy, laboratories with traditional/new-age diagnostic tools (microscope with monitor-attachment, digital-camera, laminar-flow, ELISA, PCR, LFD etc.). Incidentally ELISA kits are being developed by Ministry of Science and Technology, India. Diagnosticians and advisors include well-experienced pathologist, entomologist, agronomist/edaphologist providing diagnosis and prescription for various pests/disorders. Plant clinic is aimed at providing most accurate diagnosis of plant diseases, insects, weeds and mineral deficiency and toxicity, and offering remedial measures. Therefore the clinic will require a plant pathologist, who can lead the plant clinic. The plant pathologist must have immense capacity to diagnose many diseases and disorders visually on the basis of symptoms and sign. Plant disease diagnosis is a knowledge-driven process and in many cases trained eyes may diagnose by visual examination. However, if some lab diagnosis is needed, the farmer may be informed, and necessary advice may be passed on at the earliest opportunity by telephony or other devices. In case, problem appears complex, arrange mobile clinic to the area and inform the grower. Diagnosis is to be taken up on priority; delay in diagnosis could harm the farmer. There is no dearth of plant pathologists but there is acute shortage of trained practitioners and clinicians (Miller *et al.*, 2009) Many of

them lack insight to *Materia Medica* of plant diseases (Srivastava, 2009), which involves diagnosis and treatment with adequate knowledge on fungicides or for that matter pesticides. Therefore besides having in-depth knowledge of symptoms, a comprehensive knowledge about pesticides is highly desirable. Let us remember that during disease outbreak, only fungicides can offer respite, hence choice of fungicides, compatibility with other pesticides and resistance management is a must.

Beyond diagnostics, clinics owe responsibility of strengthening plant-healthcare by educating farmers on pest diagnosis and management, training/teaching students, producing plant doctors, keeping vigil on bio-terrorism, promoting integrated management to minimize pesticide use and saving biodiversity, monitoring pest/diseases distribution/outbreak, issuing pest alerts/warning, organizing plant health camps in clinics/farm-fairs, and strengthening mobile clinic during pest-outbreak. Other major roles involve invigorating farmers’ access to 7X12 information through toll-free-telephony, mobile/internet, providing online-advice, enhancing farmers’ knowledge-bank through innovative training/print/electronic devices, maintaining database and networking, conducting impact-assessment, revitalizing farmer-extension-research-government interface for optimizing techno-resources. Creating such clinics with difference, modeled on human clinics, providing wide range of plant health services at zero cost, shall symbolize quintessential ‘plant clinic/hospital’, commanding same status/recognition as human clinic, empowering farmers/stakeholders to improve food security. Impact of such clinic has been phenomenal in ushering productivity. Let’s collaborate and embrace thoughts and technologies to create more such clinics in India, and revolutionize plant healthcare, laying foundations of national plant health services.

PLANT CLINIC ON WHEELS – THE MOBILE PLANT CLINIC

Mobile plant clinic deserve equal attention as they come to the rescue of the growers by providing needed health care during epiphytotic outbreaks. Mobile plant clinics with modest diagnostic tools and trained professionals may provide on-the-spot diagnosis in field condition during disease outbreak. Mobile van shall carry a public address system, screen for video film, some relevant literature, and some pesticides sample likely to be

recommended during the situation. The van should be properly labeled so that it can be recognized by farmers. Such clinics have helped in averting epiphytotics in India (Srivastava, 2008a). Plant clinics may also organize camps on plant health, judicious use of pesticides, fungicide resistance management and promoting IPM besides issuing pest alerts like Plant Disease Warning issued by the author in the past. Plant clinics thus can play an important role of Savior of plants from pests and diseases.

PLANT HEALTH CLINICS IN OPERATION

Plant health clinics in India have come in a big way in recent years and have made a niche in plant health system, providing timely diagnosis and prescription, aimed at keeping pests at bay and thereby mitigating the losses. The organizations running such clinics include 1) State agricultural universities (SAUs), 2) National Horticulture Mission, Ministry of Agriculture & Cooperation, Government of India, 3) Traditional university, 4) CABI and 5) Agri. Clinic and Agribusiness Center Scheme.

PLANT HEALTH CLINICS UNDER STATE AGRICULTURAL UNIVERSITIES (SAUS)

Currently 45 SAUs, one Central Agricultural University at Imphal and four deemed universities are operating in India. In many universities plant clinics are operating under Plant Pathology Department, involving entomologists, agronomists and soil scientist for identifying insects, weeds and mineral deficiency and toxicity.

Some universities are privileged to have even independent building for plant clinic. Haryana agricultural university too at the end of 20th century came up with an independent building. The clinic besides rendering diagnostic and advisory services to farmers, also imparts specialized training to agriculture graduates on diagnostic technique of various disorders of the crops and their management, meeting the requirement of plant clinic course, which was started in Academic year 1997-98. Punjab agricultural University houses a 'plant clinic park' with four acres of land. Currently each SAU is running a clinic under 'Agricultural Technology Information Centers (ATIC). Let us hope that SAUs strengthen PHC in times ahead.

PLANT HEALTH CLINIC UNDER AGRICULTURAL TECHNOLOGY INFORMATION CENTRE (ATIC)

The establishment of ATIC serves as single window delivery system, which enables the farmers to get

required information on diagnostic services for soil and water testing, plant and livestock health. This in fact saves the time of the farmers and he has not to run at different places to get remedy to various problems. This is a unique concept provided by Indian Council of Agricultural Research (ICAR) by which farmers not only get diagnostic solution on pests but on other issues simultaneously. Currently most of the SAUs are providing diagnostic services for plant health. Many universities have provided toll free telephonic services for the benefit of farmers.

PLANT HEALTH CLINICS UNDER NATIONAL HORTICULTURE MISSION (NHM)

NHM, Ministry of Agriculture & Cooperation, Government of India has open gates for launching plant clinics in public and private sectors with active participation of ICAR (Indian Council of Agricultural Research) institutes, state agricultural universities and Krishi Vigyan Kendra (KVKs) or Farm Science Center through a liberal grant of Rs. 20 lakh per clinic. The project is aimed at providing to the farmers. As per direction of NHM, the organization shall identify the building where clinic is to be established and should have a distinct identity with clear sign board. Further clinic should be located in an area, which is easily accessible to farmers. By now NHM initiative has led to establishment of 128 plant health clinics across the country in public and private sector.

PLANT HEALTH CLINIC UNDER TRADITIONAL UNIVERSITY

Some traditional universities have made a modest beginning in extending diagnostic and advisory roles, and Botany Department of Mysore University, Mansangotri is one which has the distinction of having a Plant Health Clinic (PHC) established by Dr S Shankara Bhat, who is popularly recognized as Plant Doctor. An exhibition of important crop diseases of is held for the benefit of farmers regularly.

The clinic offers free/paid consultancy to farmers on plant disease diagnosis and integrated disease management practices. In the diagnosis modern tools are also used. Every Saturday plant doctor of the department visit the farmers field and solve the problem. Every year hundreds of farmers are making use of the facility for plant disease management. The motto of PHC is to provide eco-friendly solutions to farmers for sustainable agriculture. Let's hope other traditional universities follow suit.

PLANT HEALTH CLINIC ON CABI'S INITIATIVE

Nearly 1000 farmers in Karnataka are set to be trained as Plant Doctors in a major program funded by Karnataka State Department of Agriculture and biocontrol Research Laboratories (BCRL), part of Pest Control India Ltd. (PCI), and supported by CABI (Plantwise, 2011). 18 districts have been selected to receive plant doctor training during 2010-11 and remaining districts to be covered later next year. The trainees all come from farming families and have keen interest in agriculture. Many of them are women from disadvantaged groups – scheduled castes and scheduled tribes. By the end of March 2011 there will be enough plant doctors to run 72 independent, community-based plant health clinics throughout the state. It is, however, beyond my comprehension, if the farmer can act as a plant doctor, though elsewhere specialized training is provided to graduates to take the role of plant doctor. How a farmer-turned plant doctor can be equated with trained graduates in plant pathology is not clearly understood. In G B Pant University of Agriculture and Technology, the plant clinics are operating with the support of CABI.

PLANT HEALTH CLINICS UNDER AGRI CLINIC AND AGRI BUSINESS CENTER

The Agri Clinic and Agri Business Center Scheme has been launched by the Ministry of Agriculture, Govt. of India, in association with NABARD and coordination with National Institute of Agricultural Extension Management (MANAGE) and Small Farmers Agribusiness Consortium (SFAC) to take better methods of farming to every farmer across the country by tapping expertise available with the large pool of agriculture graduates. Such graduates can set up their own Agri Clinic and Agri Business Center and provide professional extension services to the farming community. Under the programme provision exists for setting up plant protection service center, biocontrol units etc to gain self employment, simultaneously supplement extension system. Agri clinics should, however be not confused with plant clinic as the former provides a blanket of services on agriculture, animal husbandry and allied areas.

ICT INITIATIVE IN INDIAN AGRICULTURE

ICTs have the potential to reach many farmers with timely and accessible content. According to Choubey (2009) Agricultural Informatics Development could lead to

- Information access and delivery of services for sustainable agricultural growth and livelihood.
- Adopting global best practices.
- Empowering farming community & other stakeholders.
- Promoting informatics led resource planning & management at grass-roots levels.
- Strengthening Research and Education, Training, Extension and Development linkages.
- Achieving Agriculture Online.

Undoubtedly ICTs offer the desired information most effectively but the only constraint faced by the user is lack of consistent power supply as power cut has become a phenomenon in urban areas including Millennium city, Gurgaon falling under NCR, and with no certainty of electricity in villages. To make ICT initiative a reality, the users need to be trained on use of sophisticated gadgets. Let us hope, India and its neighboring countries takes up ICT initiative in strengthening communication skill with reference to plant pests.

Internet can be a valuable source of information for farmers in developing countries, as indicated by an EU-funded, NRI-led project, TeleSupport-India. The project focused on facilitating the exchange of information and knowledge between farmers, community groups, research institutes and intermediary organizations (such as NGOs and government extension agencies) in two districts Kerala and Bengal. The results emanating from the project are encouraging and deploying ICT could be very valuable, if the power supply is regulated and assured power supply is made in villages. Further very few people have access to computers, but with growing awareness and availability of computers, internet usage may become a popular means of clinic communication, but it may take some time in rural areas. In India, however, mobile and land-line telephones have been widely used to get information from the Information centers. In India, 6 million farmers have been receiving advice through their mobile phones on everything from crop protection to fertilizers and animal husbandry as part of an innovative service provided by IKSL – a joint venture between fertilizer manufacturer IFFCO and the mobile phone company BhartiAirtel, with scientific backstopping by CABI. The service sends five free voice messages in local languages every day on issues relating to crops, pests, and markets, and also operates a

Farmers Helpline. Similarly in Rice Clinic run by PI Industries, Gurgaon, India communication are promoted by voice calls or SMS messages to farmers' phone. Fortunately most of the farmers have mobile phone and the Indian Government regularly uses the mobile network as a means of communication to farmers about soil, weather, and crop information.

Toll-free Helpline are also operating with most of the ATIC run by Extension Directorate of SAUs, on which advice on various aspects of Agriculture including pest and diseases can be availed by the farmers. In Haryana Agricultural University farmers are provided consultancy not only through telephony but also through correspondence and field visit in the event of serious outbreak of plant pests.

ONLINE PLANT HEALTH CLINIC

XSGrowth Plant Health Clinic is a non-profit organization aiming to encourage the provision of comprehensive diagnostic and advisory services for plant health around the world. It provides online diagnosis of the problem received from the growers or any individual and provides remedial measures through e-mail. Besides it also offers advice on setting up new clinic. It provides a wide range of information pertaining to plant health, which is gainfully utilized by enlightened farmers, extension workers, pest control advisors, teachers, and students alike.

The portal also displays activities pertaining to plant clinic presentation or conferences or sessions on plant health clinic. The site often receives requests from students and scientists on matters pertaining to pest management, which is provided to them and also displayed on web portal. The website warmly responds to farmer's individual problem and growers' association problem. This is the only organization, in India which is rendering online service to farming community, kitchen gardeners etc.

The two leading English dailies, Times of India & Hindustan Times besides Dainik Jagran – Hindi news daily have given coverage to the activity of the site to the benefit of the farmers at large. XSGrowth Plant Health Clinic has been listed in several web directories *for wider communication to mass internet users, as a non-profit organization aiming to encourage the provision of comprehensive diagnostic and advisory services for plant health around the world, for availing online diagnostic and advisory services rendered by Dr. M. P. Srivastava, Chairperson of XSGrowth Plant Health Clinic.*

NETWORKING OF PLANT HEALTH CLINIC

Network of diagnostic facilities or plant clinics enhance national agricultural security by facilitating rapid detection and accurate diagnosis of high-consequence pathogens and pests (Miller *et al.*, 2008). The network provides the means for rapid diagnosis, and communicating to all the participating clinics about the possible outbreak of high-risk pests and pathogens. The network may operate at international, national or even regional level. Establishment of the regional plant diagnostic clinic networks empowers rural individuals by giving communities their own capability to accuracy. Though plant clinics are increasingly established in India, coordination and networking of clinics remains a goal (Mehta, 2008; Srivastava, 2008a).

To make a beginning, I propose networking in smaller states with uniform agro-climatic scenario, which may strengthen diagnostic capability of plant clinics under network.

TRAINING AND EDUCATION ON PLANT CLINIC

Plant Pathology is a professional subject, which involves diagnosis of plant diseases and disorders and suggesting their remedial measures. This in fact is an important component of teaching and extension role. As such graduates must undergo such a training to face such challenges posed to them by farmers, development workers. The interface between a plant diagnostic clinic, the extension personnel, and the client remains one of the most effective mechanisms to disseminate diagnostic information on plant disease.

Indian Council of Agricultural Research (ICAR) initiated **Plant Clinic Course** at graduation level from Academic year 1997-98 to impart a theoretical and practical training in prevention, diagnosis and management of plant diseases, insects, nematodes, weeds, mineral deficiency and mineral toxicity and other a-biotic stress – as an integrated course. It has been a multidiscipline course involving Departments of Plant Pathology, Entomology, Soil Sciences and Agronomy. The objective in instituting this course was to empower the graduates with practical knowledge of diagnostic and plant health management so as to make the professional plant doctors who can render better service to farmers. We do not know why the course was withdrawn from academic year 2011-12? It would have been better to refine the course so that the graduates could have played a better role in sustainable agriculture. In Belgium the Plant Clinic Course has been a cornerstone in crop protection

curriculum at Catholic *University of Louvain (UCL)* since 1976. CABI has developed certain courses, which do not form a part of teaching curricula at the university level. One such course, The Global Plant Clinic's Module 1, "How to become a plant doctor", concentrates on how to diagnose symptoms of ill health in plants, and to run a plant health clinic.

While most of the university across the world lay greater emphasis on plant health management, some universities have introduced Plant Medicine Program, like Doctor of Plant Medicine (DPM) degree in Florida and Doctor of Plant Health (DPH) program, started by University of Nebraska. These professional programs provide an exciting opportunity to those who want to make a difference in these production systems. The DPH program is only the second of its kind in the US. The SAUs may think in this direction of starting an integrated program, which is more professional in nature and can be equated with practicing health care practitioners or doctors.

COMMUNICATION & DATA NETWORK - ENRICHING KNOWLEDGE BANK

- Provide Information on Integrated Pest Management, Soil health and water management, nutrient management for maintenance and sustenance of plant health.
- Correlation of climate or weather data with disease appearance.
- Help predict future pest occurrence by issuing timely pest alerts, involving print and electronic media for wider dissemination. Send handbills to village panchayata (village parliament) for faster flow of information down to farmers.

IMPROVING CLINICS COMMUNICATION

As stated earlier, we need to have a Toll-free number, so that callers may use for uninterrupted communication with the plant clinics. It could be operational from 10.00 AM to 5.00 PM. Mobiles can be very useful source of communication for giving SMS as mobile sets are possessed by an estimated 60,000 crores Indians. Internets are not used for clinical communication as few people have access to computers but it could be a valuable source of communication in near future. The possibility of its use in the villages is, however, remote due to lack of computers, internet connectivity and above all power supply. Urbanites do seek online diagnostic support via internet, though the number of such users is far less.

It must be kept in view that essentially extension is not the domain of plant clinic but certain activities do require active collaboration with partners when we look into holistic plant health, where host nutrition and healthier growth of crops cannot be ignored. These activities need not be taken up independently but can be taken up while imparting training on diagnosis of pests and diseases and their management by strengthening Research, Extension and Development linkage. Most of the field activities are not possible without maintaining active interface. Feed-back from farmers must be viewed positively for course correction.

EMPOWERING STAKEHOLDER/FARMERS WITH KNOWLEDGE BANK ON PLANT HEALTH MANAGEMENT

Once or twice in the season, such training need to be organized on field diagnosis of disease and insect-pests and their management with special emphasis on Integrated Pest Management in each crop season. The beneficiaries would be farmers and collaborating partners would be scientists, pesticide/input industry/dealers.

Plant health camps need to be organized on the analogy of human health camps, for farmers and field functionaries to bring awareness about prevalent diseases and pests, likely outbreak of other pests and diseases, steps to manage them. This will also be opportunity for farmers to get their samples diagnosed and getting recommendation and seeking solution to their various queries on plant health. The clinic in all situations may not render desirable services particularly in the outbreak of mysterious diseases and epiphytotics. Hence a mobile clinical van with modest diagnostic facilities and trained professionals can do on-the-spot diagnosis.

FUTURE STRATEGIES

Phenomenal growth in population poses serious threat to food security. It may not be an easy task to control burgeoning population but plant health can be managed by keeping pests at bay through innovative approaches and monitoring pest scenario, timely diagnosis and adoption of need-based recommendation, which may involve use of pesticides or other measures depending upon the situation. As such, we need to create enough well-organized clinic at prime location in urban and rural areas at grass root level on the analogy of primary health center, with easy access to growers, providing unrivalled timely diagnosis and prescription at zero cost

for management of problems. Clinics need to be equipped with diagnostic facility with excellent communication skill and facility/ICT, and trained manpower since diagnosis is experience driven process, organizing trainings, maintaining linkages with development agencies/electronic/print media. Monitoring and surveillance of diseases and pests, issuing pest alerts and their faster dissemination through electronic media, SMSs should be on the card. Plant health camps, training to farmers on field diagnosis of pests and diseases should be organized once or twice during the season. Clinic on wheels must be ready to face epiphytotic/pest outbreak by rushing to the affected area with team of experts. Enrichment circulars, bulletins, leaflets be brought out on regular basis for updating growers' knowledge to face the challenges. To improve the working of clinic respect the feed back from farmers, go for introspection and self-evaluation and monitoring and look at the future for the well-being of farmers producing food for us. Let us expect the boom of plant clinics laying the foundation of plant healthcare system. Creation of well-organized clinics modeled on human clinic would not only boost food security but would help the image of the plant doctors commanding same respect as the human doctors or veterinarians enjoy. Let us rediscover Plant Health Clinic, which can heal the wound of farmers by providing unstinted plant health care support by extending timely diagnosis and recommendation to save the crops from ravages of diseases and pests. Let all governments rise to the occasion to save huge crop losses by supporting creation of plant clinics and prioritize plant clinics in 12th Five Year Plan.

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