Food Security at Stake: Challenges and Opportunities

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3rd International Conference on Agriculture and Horticultural Sciences, October 27-29, 2014, HICC, Hyderabad, India

Food Security

Food Security implies availability of food to every one in all times to come

As a state of affairs where all people at all times have access to safe & nutritious food to maintain healthy and active life FAO

Food: Basic Requirement of Man

[without food survival at stake]



Threat to Food Security

- **EVER RISING POPULATION – *The biggest threat***
- **URBANISATION & INDUSTRIALISATION - LAND CRUNCH**
- **CLIMATIC CHANGES**
- **LOSSES DUE TO PESTS /DISEASES & DISORDERS**



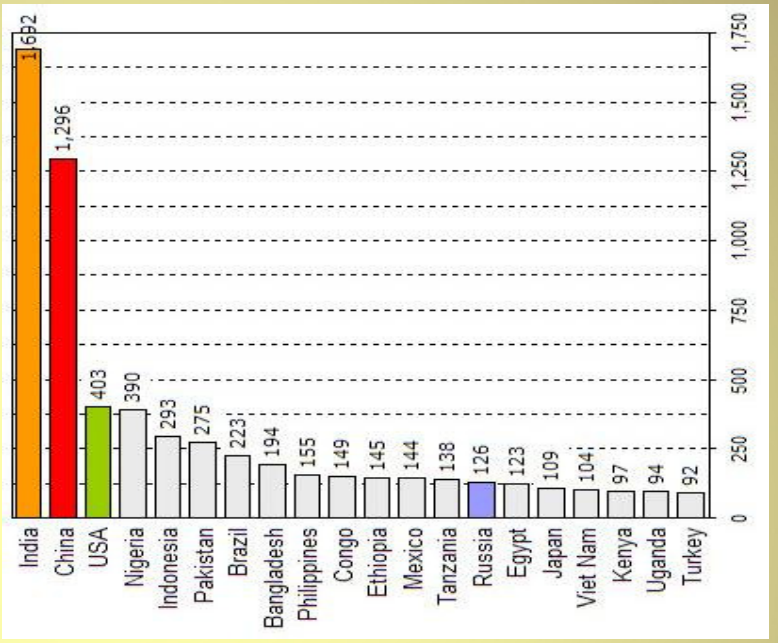




Population Explosion by 2050

By 2028, India & China to have 1.45 billion people.

India's population growth is tipped to continue until 2050, while China's population is projected to start declining after 2030. World population my reach 9.7 billion by 2050



- **Currently 80% global population live in developing nation where annual increase in population is 1.9 per cent**
- **Estimated 800 million hungry people live in developing countries of Asia, Africa and Latin America.**

How to Assure Food Security?

- Managing population explosion ?
- Increasing arable area
- Checking industrialization of
- agricultural land
- Can we check urbanization ?

3rd International Conference on Agriculture & Horticultural Sciences
27-29 October 2014, Hyderabad International Convention Centre (HICC) India

How to Assure Food security?

Can we manage population? A very sensitive issue,

- Only regulatory measures,
- Political will ,
- Social awareness & commitment

can help to curb population explosion, as in China –

But not an easy task! Its a hard nut to crack

CLIMATIC CHANGES

A natural phenomenon -
also influenced by man's action

Check Plant Pathology Volume 60 (1) Feb 2011; Guest Editor: Sukumar Chakraborty, dedicated to Climate change & plant diseases

Plant Pests and Food Security

Losses due to Plant Pests globally



Conservative Estimate	**30 per cent**
Oerke *et al* (1994)	**40 per cent**
Beldt & Ellis, (1998)	**40 per cent**
Ramasami (2008) India	**Rs.1,40,000 crores**







Innovation beyond Imagination

Holistic Plant Healthcare towards Plant Health & Reducing losses

- Host resistance
- Biotechnology – Transgenic/ GM Food
- Organic Farming
- Good agricultural practices (GAP) /Integrated crop management (ICM)
- Integrated nutrient management (INM)
- Pesticides
- Integrated Pest Management (IPM)

Plant Health Management

- Host resistance:

  SAU/ Krishi Vigyan Kendra, Ag. Department

- Biotechnology – An innovative approach

  Development of transgenic/GM crops to fight against pests & diseases implies reduction in pesticide use, but faces health & environmental concern. EU has not allowed GM food for consumption

Biotechnology

- Aimed at raising transgenic or GM crops which require little or no pesticides
- Bt cotton first transgenic in India, completes 10 years journey, with remarkable success
- Bt brinjal – awaits clearance for cultivation, Sole reason: health & environment concern to ensure consumer safety
- European Union does not allow GM food; Canada, US, Brazil, Argentina introduced GM food – soybean, rape & sweet corn

Organic Farming

- It has become the buzz word signifying healthy food free from pesticide residue
- Best option growing food without pesticides & chemical fertilizers
- Cost of produce exorbitant hence beyond reach of common man
- Higher return incentive to growers
- However, certification has to be stringent



Plant Health through Plant Protection

- To feed forecasted 10 billion people by 2050 or 15 billion by 2070, a staggering increase in food production will be needed.
- An important route to sustainable food production is reducing losses, increasing productivity, by keeping pests at bay through timely diagnosis and advisory from Plant Health Clinic (PHC)

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Pesticides:

[Fungicides/Insecticides/Herbicides]

- Very often all efforts to get higher productivity gets jeopardized due to pest invasion
- It is then only input, which offer respite during disease/pest outbreak.
- *Recent generation or 4G fungicides, besides being effective have least impact on bio-diversity*
- Improve crop yield & quality
- Success depends upon Right choice & timely application, host susceptibility, disease severity

FUNGICIDES IN PLANT DISEASE CONTROL

[Epiphytotics /Food scarcity – Development of fungicides]

- Sulphur, Bordeaux Mix, Cu oxychloride, Cu hydroxide,
- Dithiocarbamates
- Captan, captafol, dinocap
- Carboxin, oxycarboxin, carbendazim, benomyl
- Edifenphos, IBP, tolcophos methyl
- Phenylamides ; Alkylphosphonate
- Triazoles; Melanin Biosynthesis Inhibitors; PSIs
- Phenyl pyrroles & Strobilurins/STAR fungicides

Recent Generation Fungicides

- **Phenyl amides-** Acyl alanines: Effective against Downy mildews; Weakness: Resistance development
- **Alkyl Phosphonates** : fosetyl-Al – rare example of phloem-mobile product- H_3PO_4, which readily produced in aqueous solution, Highly effective against Phytophthoras
- **DMI/SBI**/Triazole: Effective against wide range of pathogens- smut, bunt, powdery mildew etc
- **MBIs**: tricyclazole, pyroquilon – highly effective blasticide
- **PSIs**: Kasugamycin, Blasticidine-s – Rice blasticides; Streptomycin, oxytetracycline – Antibacterial antibiotic

Recent Generation Fungicides-II – The Novel Fungicides

- **QoI /STAR Fungicides:** Novel mode of action, unique mobility in plants and control wide range of pathogens (azoxystrobin, dimoxystrobin, enestrobin,fluoxastrobin, kresoxim methyl, metominostrobin, orysastrobin, picostrobin, pyraoxystrobin, pyraclostrobin, trifloxystrobin, pyrametastrobin); Non Strobilurin (famoxadone, fenamidone, pyribencarb) – High Risk Fungicides
- **QiI Fungicides:** Cyano-imidazole (Cyazofamid) Novel mode of action – Highly effective against Oomycetes – Resistance Risk unknown (M to H)
- **Phenyl pyrolles:** Fenpiclonil, fludioxonil – Broad disease spectrum but inactive against phycomycete fungi. Believed to cause several changes in metabolism

Modern Fungicide - Incredible

- Affordable, More effective
- Safer & Eco-friendly
- Control easier than before with safer fungicides of 4th Generation including Strobilurins

  - Loose Smut,

  - Downy- and Powdery mildews,

  - Rice Blast, Late Blight etc., and many more

Hazards due to indiscriminate use of pesticides

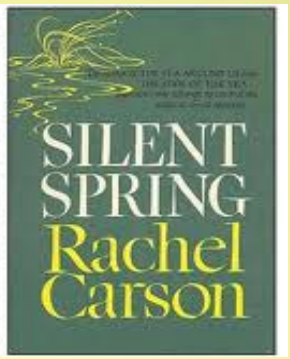
- Hazard to man,
- Environment and
- Eco-system

Guidelines to prevent hazards:

- Central Insecticide Board, SAUs & Pesticide Industry,
- EPA & PAN International,
- FRAC, IRAC, HRAC

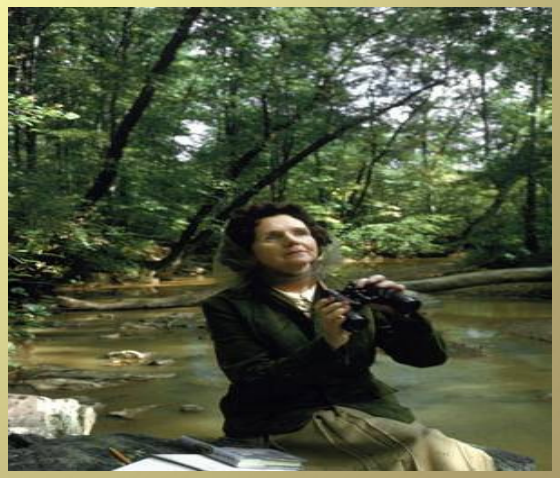
Environmentalist's vision on pesticides





Rachel Carson (1962) "Silent Spring". Houghton Miffin, Boston, USA

Miss Rachel Carson – A Biologist & Nature lover turned journalist



Impact of Silent Spring

- Global awareness on Environmental Protection (EP)
- The book brought 14000 scientists, lawyers and employees to fight for EP, which even Carson has also not anticipated
- President Nixon formed Cabinet level committee in May 1969 to assess impact of Silent Spring
- Led to birth of EPA on December 2, 1970 – extended shadow of Carson with no exaggeration
- Later in 80s till today people realized her concern which led to adoption of IPM, organic farming etc

What others speak on pesticides

- SINCE SILENT SPRING

  By Graham, F Jr ((1970), Houghton Miffin, Boston, USA

- SILENT SPRING REVISITED

  By Conar Mark Jameson;American Chemical Society (1987)

Both support Rachel Carson in minimizing pesticide usage by adoption of IPM and encouraging use of natural resources

Pesticides Hazards

- **Are pesticides really hazardous?**

  Yes, they could be to man, environment & ecosystem

- **Are pesticides really responsible for hazards?**

  No, its man's folly due to misuse and abuse.

  The notion is misconceived

- **Prevent hazard following guidelines provided by**

  1) Central Insecticide Board 2) SAUs 3) Pesticide Industries 4) EPA, 5) PAN International and FRAC, IRAC, HRAC

Can pesticide be kept at bay?

- No, "Pesticides are Necessary Evil in Plant Protection", they can not be avoided, but need to be used sensibly & judiciously
- Make Central Insecticide Act more stringent
- Pest control advisors to render right guidance keeping in view humanity, environment and mother earth
- Sensitize users, educate pest control advisors

How to Minimize Use of Pesticides and Preventing Hazards?

- Integrated Pest Management (IPM) – a holistic approach
- Biotechnology: Use of GM crops – Bt cotton; Bt food?
- Organic farming: producing food without using chemicals

Integrated Pest Management (holistic approach)

- Shed over-dependence on pesticides
- IPM concept first proposed by Stern *et al* (1959)

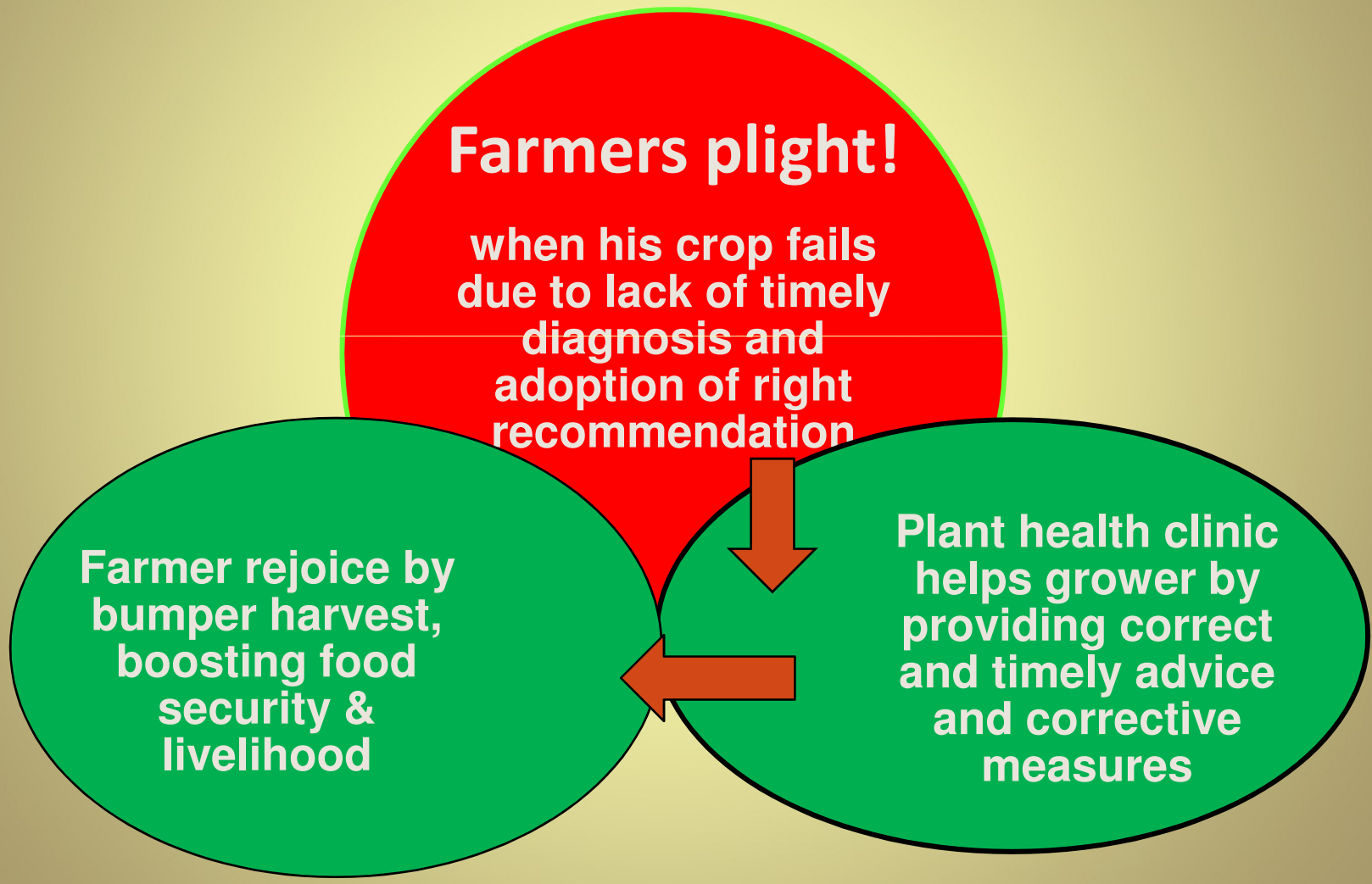
  "A suitable blend of pest suppression technique involving resistant varieties, cultural practices, biocontrol agents, and simultaneously cutting down pesticide appreciably – socioeconomically acceptable & ecologically sound"
- Caught global attention after UNCED conference (1992) and widely practiced
- In India ICAR, SAUs, NIPHM laying special emphasis
- Member states in EU committed to IPM adoption completely by January 1, 2014

Integrated Pest Management

Bajwa, WI & M. Kogan, 2002 Compendium of IPM definitions (CID), OSU, USA

"Integrated control is a pest management system that in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest populations at levels below those causing economic injury." – FAO, 1967

Plant Health Clinic



Global Scenario
of Plant Health Clinics & Their Modus Operandi

Have physical identity & operate at permanent location

- USA, CANADA, UK : Operating in State varsities/State Department Agriculture
- INDIA :Operating under
  - State Ag universities/ ATIC/KVKs/
  - National Horticulture Mission, Dept of Agr, Govt of India
  - for operation of PHC at public & private sector
  - NABARD
  - Traditional university like Mysore University

Global Scenario of PHCs & their Modus Operandi-II

[Lacking physical identity, operating under CABI's GPC Program (Now Plantwise since 2010)]

Operate as Community-based, Walk-in-Clinic/mobile clinic at public/market places

Operate in 31 countries

6 (Nicaragua, Honduras, Barbados, Grenada, Trinidad &Tobago, Surinam) in in Caribbean & Central America

3 (Bolivia, Peru, Brazil) in Central America.

12 (DR Congo, Kenya, Rwanda, Sierra Leone, Tanzania, Uganda, Ghana, Ethiopia, Malawi, Mali, Zambia, Mozambique) in Africa.

2 (Pakistan & Afghanistan) in C&W Asia

4 (Bangladesh, India, Nepal, Sri Lanka) in South Asia,

1 (China) in East Asia,

3 (Cambodia, Vietnam & Thailand) in SE Asia

Plant Health Clinic (PHC)

Transforming Plant Health Care System

Physical Infrastructure

- Building Having reception counter with overhead running electronic scroll, library, Exhibition hall with blow-ups and exhibits of plant pests, agro-pharmacy, café & toilet
- Common hall with cubicles for diagnosticians
- World class lab with microscope with monitor attachment, Laminar- Flow, ELISA, LFD, PCR, Digital Camera, Computer, Colored Compendia
- Communication/ ICT facilities

Human resource

- Pathologist, Entomologist, Agronomist & Edaphologist

PLANT HEALTH CLINIC

Plant clinic/Plant diseases clinic/Plant healthcare
Plant diagnostic clinic – Relevance & Role

- **Major role**:
- Diagnostic & Advisory to mitigate losses

Other roles:

- Training & education to farmers on field diagnosis of pests , GAP, INM / IPM / Pesticides
- Training on management of pesticide resistance
- Training & education to produce fleet of Plant Doctors
- Gathering pest scenario input from Extension staff suggesting strategies for pest control, keeping vigil on bioterrorism
- Issuing pest alerts-print / radio/ TV/ SMS/E-mail

Plant Health Clinic (PHC): Extended Roles

- **Plant Health Camps on campus and elsewhere**

  1. Diagnosis & remedies, 2. Stress on IPM, 3. Safe use of pesticides,
- **Clinic on wheels, clinic online, tele-clinic**
- **Issuing pest alerts/notifying exotic pests**
- **Strengthening communication deploying ICT, toll-free telephony, print and electronic tools**
- **Empowering farmers with knowledge and easy access**
- **Strengthening farmers linkage with development agencies,**

Plant Health Clinic and Growers

- A novel paradigm, to provide timely and accurate diagnosis of pests/diseases/disorders
- Listen, record, any treatment by grower- diagnose visually, if possible, or else go for lab testing
- Advisory
- Render Prescription/remedial measure through pesticides for immediate relief or Integrated approach
- Plant doctors play similar role as physicians in the hospital

PLANT HEALTH CLINIC

Department of plant Pathology,

CCS Haryana Agricultural university, Hisar, India

PHC/ Prescription: *353* ***Dated:*** *11/02/1987*

Farmer's name & address: *Mr Ram Niwas, Chrakhi Dadri, Bhiwani*

Crop history, problem and action taken by the famer: *Wheat Cv WH-147, Foliage with grey/lead coloured striation of smut sori, matured ones shedding black soot*

Diagnosis: *Flag smut (Urocystis agropyri)*

R_X

1. *No corrective measure at this stage.*
2. *Gently uproot infected plants, place in paper bag and burn*

For future guidance:

3. *Follow crop rotation by avoiding wheat next season.*
4. *Sow seed treated with carboxin or tebuconzole (also control seed-borne infection of loose smut & Karnal bunt)*
5. *Avoid sowing in light soil*



Pesticides are hazardous, use only if advised. Better adopt IPM-affordable, safe to man & environment

Need for Organized Clinic or Polyclinic

Integrated approach in diagnosis and treatment of plant ailments

- Plant clinics modeled on human clinic to offer diagnosis and prescription of all ailments:



- **Fungal / Bacterial / Viral / Nematode**
- **Phanerogamic parasites**
- **Insect-pests Weed**
- **Chemical injury / Pesticide toxicity Mineral deficiency**
- **Chill, Frost, Sun scald, & other environmental injury**

- Creation of organised Plant Clinic will not only serve the farmers but elevate the image of practitioners

Outlook of Model Plant Clinic/Hospital

- Centrally located in urban and rural areas, easily accessible, growers'-friendly

- Name of the clinic in English/Regional language with green cross



+ HYDERABAD PLANT HEALTH CLINIC +

[Plant hospital in the service of farmers]

Visit for free diagnostic and advisory services on plant ailments

All days except Sunday from 9 AM to 5 PM

Visit with plant sample

- *3rd International Conference on Agriculture and Horticultural Sciences,*
- *October 27-29, 2014, HICC, Hyderabad, India*

Success Parameters

- **Availability of Diagnosticians / Plant Doctors**
- **Diagnostic Skills**
  - **Trained personnel**
  - **Required equipments**
  - **Reference books / bulletins**
  - **CD ROM's on diseases & other pests**
- **Decision making in recommendation**
  - **Right kind of prescription with clarity**
  - **Ad- hoc / need-based recommendation**

पौध रोग संरक्षिका

वर्ष 13 जून-जुलाई, 1989 अंक 6-7

लोकप्रिय प्रौद्योगिकि विशेषांक

प्रिय पाठकों !

अनुसंधान द्वारा विकसित प्राद्योगिकि जब तक कृषक समुदाय तक न पहुंचे तब तक अनुसन्धान व्यर्थ है। आवश्यकता है प्राद्योगिकि को साधारण व्यक्ति के लिए विभिन्न माध्यमों द्वारा लोकप्रिय बनाना। प्रकाशन, इस उद्देश्य से संभवत: एक लोकप्रिय माध्यम है। पौध रोग संरक्षिका द्वारा पिछले 12 वर्षों से उन्नत प्राद्योगिकि हम जनसाधारण तक पहुंचाते रहे हैं और हमें प्रसन्नता है कि न केवल हरियाणा प्रदेश बल्कि निकवर्ती प्रदेशों के किसान भाइयों ने भी लाभ उठाया है और समय-2 पर उन समस्याओं का समाधान भी प्राप्त किया है जिनका उल्लेख इसमें नहीं किया गया है।

मुझे आशा ही नहीं वरन् पूर्ण विश्वास है कि हमने जो प्रयास प्राद्योगिकि को लोकप्रिय बनाने के लिए किया है उसका कृषक समुदाय व जनसाधारण भरपूर लाभ उठाता रहेगा।

प्राद्योगिकि को और भी लोकप्रिय बनाने में आपके सुझावों का स्वागत होगा।

—एम. पी. श्रीवास्तव
वरिष्ठ विस्तार विशेषज्ञ (पादप रोग विज्ञान)

जीवाणुज अंगमारी से धान की फसल की सुरक्षा

धान की अधिक उपज देने वाली बौनी किस्मों की विस्तृत क्षेत्र में सघन खेती के फलस्वरूप जीवाणुज अंगमारी (**बैक्टीरियल ब्लाइट**) की भी समस्या बढ़ती जा रही है। प्राय: करनाल, कुरुक्षेत्र व अम्बाला जिलों में कई स्थानों पर इनका भयंकर प्रकोप देखने में आता है। विशेषकर जहां पानी अधिक बरसता हो और साथ ही हवा में नमी अधिक होने के साथ-साथ तापमान ज्यादा (30-35° से.) हो वहां पर रोग भीषण रूप धारण कर सकता है।



इस रोग के आक्रमण से पत्तियों के सिरे से एक या दोनों किनारों से बादामी रंग के लहरदार धब्बे बनते हैं जो कि नीचे की ओर बढ़ते हैं। कभी-कभी मध्य सिरे के साथ भी धब्बे बनते हैं और पत्तियां किनारे से हरी बनी रहती है (चित्र)। नम मौसम में पत्तियों पर जीवाणुज स्राव निकलता है जो सूख कर सेहुए रंग के कण के समान दिखाई देता है। रोग की उग्र अवस्था में सारी फसल सूखी सी दिखाई देती है। धान के बीज भी रोगग्रस्त हो सकते हैं लेकिन प्रत्यक्ष लक्षण दिखाई नहीं देते।

यह बीमारी **ज़ैन्थोमोनास कैम्पेस्ट्रिस** पी. वी. **ओराइज़ी** नामक जीवाणुज से पैदा होती है जो कि रोगग्रस्त बीज, पुआल, डण्ठल तथा कुछ जंगली घासों पर जीवित रहता है। पत्तियों पर

PLANT DISEASE WARNING

Vol. XIX
No. 4
15.11.89

Control wheat diseases through seed- and soil-treatment

Wheat crop suffers from a number of seed-and soil-borne diseases which can be controlled by adopting suitable preventive measures at the time of sowing. Their control is, however, difficult once they have appeared in the field.

Loose Smut

Loose smut, locally known as *Kanduva, Kungi, Kawwa* or *Kangiani* is a internally seed-borne disease caused by a fungus, *Ustilago tritici*. Seeds harbouring the fungus inside, with no apparent symptom when sown produce smutted ear-heads (Fig. 1). It can however, be controlled effectively by treating the seed with Vitavax or Bavistin or Benlate @ 2 gm/kg seed before sowing. Certified seed normally need not be treated with fungicide. Seed treatment must be carried in susceptible varieties more so in C-306 and S-308. Seed earlier treated with solar heat during May-June, however, do not require chemical treatment. Fungicidal treatment is also effective against seed-borne infection of Flag smut (*Ceratocystis tritici*) which is characterised by the appearance of lead coloured parallel bands on leaves and leaf sheath which on rupture release black powdery mass. This disease had affected large area last year in village Sarang Pur in Bhiwani district and in small areas in Kundi village in Hisar hence farmers have to be vigilant.



Fig. 1 : Loose smut of wheat

Karnal bunt

Partially, very rarely, wholly some grains in an earhead get converted into black powdery mass. Rotten Fishy smell in the bunted

Plant Disease Warning welcomes the delegates attending the Annual Meeting & Symposium on Chemotherapeutic control of plant diseases on Dec. 4-5, 1989.

Issued by : Dr. M. P. Srivastava, Professor of Plant Pathology, Directorate Ext. Education Haryana Agril. University, Hisar.

PLANT PATHOLOGY COURIER

PLANT DISEASE WARNING

Vol. XIX
No. 3
2.9.89

BLAST COULD BE DISASTROUS TO BASMATI RICE

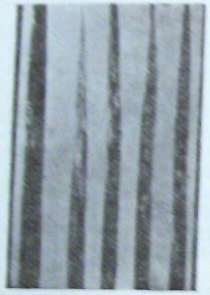


Fig. 1 : Leaf blast

While Basmati rice has been quite remunerative to farmers, Blast disease has posed a serious threat to this prestigious variety. It caused tremendous losses during 1986 and to a lesser extent in 1987 & 88. A strong vigil on its appearance and spread is a must otherwise it could prove disastrous to indigenous and Pakistani Basmati. The disease has just made its appearance on leaves of these varieties at certain places in Karnal, Kurukshetra and Ambala because of prevailing high humidity and low night temperatures.

The disease is characterised by production of spindle shaped spots with purplish margin on the leaves (Fig. 1). Although its intensity is low at the moment, yet, it may assume serious proportions, if the night temperature remains around 20°C or ranges between 20 and 26°C with RH 90% or more for a week. If foliar infection is not checked immediately, brown-black ring may appear at the base of ear heads causing 'neck blast' (Fig. 2) resulting in half-filled or chaffed grains.

In order to control the disease it is desirable to check foliar infection by spraying Basmati crop immediately with 500-625 ml Hinosan or 500-625 g carbendazim (Bavistin) diluted in 500-625 litres water/ha. For preventing neck blast, spraying with any of the above fungicides may be undertaken once at panicle emergence and again after a week.



Fig. 2 : Neck blast

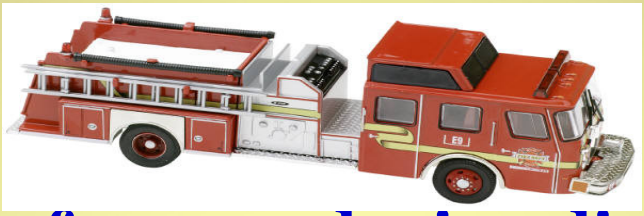
Issued by : Dr. M. P. Srivastava, Professor of Plant Pathology (E), Directorate Ext. Education, Haryana Agric. University, Hisar

Visitors Record & Problems

Date	Visitors name & address	Crop / Problem	Recommendation	Referred to	Follow - up

Clinic on Wheels –

Mobile Plant Clinic to criss cross in the villages



- ❖Unique service to farmers during disease outbreak
- ❖A service to community and region by offering on the spot advice and creating mass awareness
- ❖Educating people of the area facing the problem through mass media

a) Print media- pamphlets, handbills etc.
b) Electronic media – films, slides etc
c) Public address system
d) d) SMSs

Online Plant Health Clinic



- Strengthen online diagnostic and advisory role
- A good tool to urbanites having internet
- If the problem appears ticklish, ask the person to visit the clinic, rather than giving vague solution.

Future Strategies

- Diversify plant clinics, take it to grass root level, by creating at subdivision level
- Let this conference show the roads for others to follow and witness boom of plant clinics in the country
- Creation of well organized clinic on the analogy of human clinics, providing free services, will be true gifts to growers,
- Revolutionize plant health care and practitioners will command same respect as physicians in the society by virtue of their uncompromising services

Humble Submission

1. Bank upon Plant Clinic for Diagnostic& Advisory support to reduce losses, increase productivity and boost Food Security
2. Empower farmers with Knowledge
3. May your efforts strengthen Food Security and no one is deprived of Food

Thanks  Audience

3rd International Conference on Agricultural & Horticultural Sciences,

October 27-29, 2014, Hyderabad International Convention Centre, Hyderabad, India