Importance of Plant Pathology in Agriculture:

1. Plant pathology has advanced the knowledge to protect the crop from losses due to diseases.
2. The science of plant pathology has contributed disease free certified seed production.
3. Most of the diseases with known disease cycle can now be avoided by the modification of cultural practices.
4. With the knowledge of mode of disease spread, many diseases of economic importance can now be checked, minimized or controlled.
5. Crop improvement and varietal resistance have been achieved against many diseases through the joint effort of breeder and plant pathologist.
6. Plant pathology has made possible to restrict the spread of plant diseases from one place to other and one country to other through suitable measures and quarantine legislation.
7. With the knowledge of plant pathology various prophylactic measures are adopted for successful management of diseases. These measures are seed treatment in seed borne diseases soil treatment and crop rotations.
8. Diseases can be avoided in cold storage by the application of plant pathological measures as per recommendations made for different diseases for protection of fruits and vegetables in storage.
9. Plant pathology has made possible to recognise, discard or utilize toxic substances by producing toxic substances or by competition or by parasitism. Organism exerting such lethal or damaging effect on the other is called antagonist

Scope of Plant Pathology

1.Survey of fields, orchards and areas in order to find out prevalence of diseases and their incidence.

2. Recording new diseases of economic importance if any, with their identification and extent of incidence.

3. Assessment of losses caused by different diseases of economic importance.

4. Study of etiology, symptoms, predisposing factors and recurrence of such diseases.

5. Find out suitable and economic methods of management of economically important plant diseases.

6. Assisting in breeding of disease resistant varieties.

7. To train the extension workers and subject matter specialists in order to bridge the gap between pathologists and farmers for better crop production.

Plant Pathologist

Dr. R.K. Jain, born on 21st May, 1956 at Rohtak, Haryana. He obtained his B.Sc. degree from S.D. College, Ambala Cantt. in 1974, M.Sc. degree from G.B. Pant University of Agriculture & Technology, Pantnagar in 1977. He completed his Ph.D. programme in 1988 from IARI, New Delhi. He was awarded FAO Fellowship during the period 1990-91 and DBT Overseas Associateship during the period 1997-98. He did his Post Doctorate from CSIRO, Melbourne, Australia; University of Florida, Gainesville, and University of Georgia, Tifton, USA.

He served as Scientist (Plant Pathology) in Central Rice Research Institute, Cuttack from 1978 to 1986. Subsequently, he joined IARI as Senior Scientist in the Division of Plant Pathology in 1986 and was elevated to the post of Principal Scientist in 1998. In 2007, he joined as Head, Division of Plant Pathology, IARI and continued till December 2013.

As an outstanding Plant Virologist, his research canvass includes emerging plant viruses such as "Tobacco streak virus (TSV) affecting sunflower and groundnut, Papaya ringspot virus (PRSV) affecting papaya and Groundnut bud necrosis virus (GBNV) affecting tomato with reference to assess their distribution profile and genetic diversity, development of diagnostics and virus resistant transgenic plants (VRTPs).

He is recipient of IARI Gold Medal, 1989; M.J.Narasimhan Award 1999; IARI Best Teacher Award, 2004; Vasvik Award, 2007; Hari Krishna Shastri Memorial Award, 2010; B.B. Mundkur Memorial Award, 2011.

He is the Fellow of National Academy of Agricultural Sciences; Indian Phytopathological Society and Indian Virological Society. He was the President, Indian Phytopathological Society, 2009; Vice-President, Indian Virological Society, 2011 and Editor-in-Chief, Indian Journal of Virology, 2008-11.

Dr. R.S. Mehrotra

He was born on 4th January, 1937 in Village Anantram, District Etawah, U.P. He did his M. Sc and Ph. D from the University of Saugar, Sagar (Now known as Dr. Hari Singh Gaur University), M.P. in the year 1958 and 1961 respectively. For his Ph.D degree he worked on the foot rot and leaf rot of Piper betle and their control under the supervision of Late Prof. S.B. Saksena. He joined the University of Saugar, M.P.in the year 1964 as Assistant Professor and then later shifted to Kurukshetra University, Kurukshetra in year 1970 as

Reader then Professor in the year 1978. He retired from Kurukshetra University in the year 1997. He was Post Doctoral Fellow at the University of Western Ontario, London, Ontario, Canada in the years 1968-1970 and worked in collaboration with late Prof. C.J. Hickman on the biology of Phytophthora Zoospores in soil using fluorescent brightenersand fluorescent microscopy. He was also a Fulbright Fellow at the University of California, USA Riverside campus for a short duration in the year 1979 and worked in collaboration with world authority on Phytophthora, Prof. G.A. Zentmyer.

Professor Mehrotra was a Fellow of the National Academy of Sciences (Allahabad). He was elected President of the Indian Phytopathological Society in the year 1990. He was also elected President of the Indian Society of Plant Pathologists in the year 1992 and President of the Mycological Society of India in the year 1996. He was elected President of the Botany Section of Indian Science Congress in the year 1997 and is a recipient of the BirbalSahni Gold Medal of the Indian Botanical Society in the year 1998.

The main thrust of his research work has been on Phytophthora diseases of various crops and fungal soil borne diseases and bio-control of plant pathogens. He has authored four books viz. Plant Pathology (1980), An introduction to Mycology (1990) a monograph on Phytophthora Diseases in India (2001) and Principles of Microbiology (2009).Professor Mehrotra has written several review articles and published more than 200 research papers in national and international journals.

Rangasami

Passing out of the Agricultural College, Coimbatore in 1946, with the first degree in Agriculture and as a rank holder and award winner in Agricultural Botany and Plant Pathology, he was appointed as a Research Assistant in Mycology Division of the College, where he had the opportunity of getting trained under the then leading Mycologists such as Prof. K.M. Thomas and Prof. T.S. Ramakrishnan. During his deputation period of 1951-53 to the Indian Agricultural Research Institute, New Delhi for Associateship, he had the opportunity of getting the best training under Dr. R.S. Vasudeva. Working on the survival of plant pathogens in soil, he was able to isolate the chemical from Bacillus sp., which inhibited growth of Alternariasolani, and was named ‘Bulbiformin’. His work got him recognition along with the first rank and first class in the Institute. Soon he got admission in the newly started Institute of Microbiology at Rutgers State University, N.J., USA, built from the royalties of the wonder drug Streptomycin, where he was fortunate to work directly under the guidance of Dr. Selman A. Waksman, Nobel Laureate and Director of the Institute. His Ph.D. thesis covered the discovery of a new antibiotic named

‘Streptothricin’ and its antifungal activities and also use of other antibiotics on plant disease control.

Important Contribution of Indian Psychopathologist

E.J Butler:
Mycologist at IARI, New Delhi since 1905 to 1921 and trained many workers in Mycological and Plant Pathological Research. He wrote a Book- “Fungi and Disease in Plants” in 1918. Appointed as first Director of CWMI – in Britain. He is called as the “Father of Modern Plant Pathology in India.
K.C.Mehta (1892-1950):
Physiology and Epidemiology of cereals rusts in country. Monograph on further studies on cereals rusts in India, in 1940.
B.B.Mundkar (1896-1892):
Worked on cotton wilt in Bombay state, published ustilaginales in India. Pioneer in establishment of Indian Psychopathological Society (IPS) in 1947 and its organs Indian Phytopathology in 1948. He worked on Smut Fungi. Author of Fungi and plant diseases.
B.N. Uppal:
He worked on Downey mildew of Maize, Bajara and showed physiologic specialization in Sclerosporagraminicola. He worked on several fungal and bacterial diseases.
G.S. Kulkarni:
Downey mildew of Sorghum and Pearl millet, sorghum Smut.
V.P.Bhide:
Bacterial diseases of plant.
M.J. Tirmalachar:
500 research papers, 20 genera and 300 species of fungi. He discovered antibiotic Aureofungin.
G.Rangaswami:
Nematode, bacterial and other diseases.Published 5 books of micro biology and plant pathology and over 300 research papers.
P.N.Patel: Bacterial disease of plant.

Dusters:

All dusters consist essentially of a hopper which usually contains an agitator, an adjustable orifice and delivery tubes. A rotary fan or a bellows provides the conveying air.

A) Manually Operated Dusters:

1. Plunger Duster: It is simple in construction and consists of a dust chamber, a cylinder with a piston or plunger, a rod and a handle. It is useful for small scale use in kitchen garden and in household.

2. Bellows Duster: It has a pair of bellows made of leather, rubber or plastic. The bellows can be worked with a handle just like a Blacksmith does. The dust is placed either in the bellows or in a separate container made of wood, metal or plastic attached to one end of the bellows..

3. Hand Rotary Duster: They are also called crank dusters and fan type dusters.. It is used for dusting field crops, vegetables and small trees and bushes in orchards. The efficiency of these dusters is 1 to 1.5 ha/day.

B) Power Operated Duster:1) Engine operated dusters 2) Wet dusters

Rat Fumigation Pump: It is a plunger type of duster with an air pump, a dust chamber of about 500 g capacity and discharge tube.

b) Soil Injector: It is also known as soil gun, which consists of a cylindrical tank for the liquid fumigant, a pump barrel and plunger assembly, injector nozzle, thrust handle and injection handle. They are used to apply liquid nematicides to kill soil nematodes.

c) Granule Applicators: They are used to apply granular formulations of pesticides uniformly. These are two types of granular applicators. 1) There is a plastic hopper 1 liter capacity from which the granules flow by gravity to a nozzle. 2) It is a knapsack type with hopper of 10 liters capacity.

d) Bird Scarer: It is a device to scare away birds and wild animals like jackals by producing noises. It has three essential chambers, a chamber to hold calcium carbide, a smaller chamber placed inside the former to hold water and combustion chamber attached to the main chamber.

e) Rat Traps: Several types of mechanical devices for trapping rats and mice are used in India. In these traps baits like dry fish are used for attracting these rats. The cage type wooden box with a door closing device and spring board types are the more common ones used in the houses.

f) Flame Thrower: It is a compressed air sprayer filled with kerosene oil for producing flames. There is lance, which is fitted with a burner. When the burner is heated the kerosene oil is released and it burns into flames. It is used for burning locust populations.

g) Seed Dresser: It is comprised of a drum rotated with a handle. It is mostly used for seed treatment with insecticides.

Plant Protection Equipment Sprayers

Depending upon the quantity of spray fluid required per unit area, the sprays are described as i) High volume sprays ii) Low volume sprays and iii) Ultra – low volume sprays. The spray fluid of 450 to 1000 liters; 12 to 125 liters and 0.5 to 6 liters will be required to cover one hectare of field crop with above mentioned sprays respectively. However the droplet size of these three sprays varies from 250 to 500, 150 to 250 and 70 to 150 microns respectively.

Types of Sprayers:

I) High Volume Sprayers:

A) Manually Operated Hydraulic Sprayers:

1. Hand Syringe:

It consists of a cylinder and a plunger, spray fluid has to be contained in a separate tank. The liquid is drawn on return stroke of the plunger and ejected during the compression stroke. After each ejected the spray fluid has to be drawn in. It is useful for small scale spraying in kitchen gardens and pot plants.

2. Bucker Sprayer or Stirrup Pump:

It may consist either of a double acting pump with two cylinders or a single acting pump with one cylinder. The other parts of the sprayer are the plunger assembly, foot value assembly, hose, lance and nozzle, a stirrup and an adjustable foot rest. The pump has to be put in a bucket of any container having the spray fluid. In the single acting pump the spray discharge is discontinuous since the fluid is ejected only during the downward compression stroke, while in the double acting pump the discharge is continuous as the fluid is discharged during both sucdon and pressures strokes. This type of sprayer is useful for spraying small trees. Area covered per day is 0.5 to 0.8 ha.

3. Knapsack Sprayer:

This type of sprayer has a flat or bean shaped tank. The tank has a capacity of 10 to 30 liters and is made of galvanized iron, brass stainless steel or plastic. It is similar to bucket type in principle. It is operated by a lever handle provided inside the tank and it moves up and down inside the container due to the movements of the pump lever. It is user for spraying field crops vegetables and nurseries. The area covered per day is 0.8 to 1 ha.

4. Rocker Sprayer or Gatoor Pump:

It consists of a pump assembly, a rocking lever, pressure chamber, and suction hose with a strainer, delivery hose, cut-off valve and spray lance with nozzle. By rocking movement of the lever pressure can be built in the pressure chamber and this helps to force the liquid through the nozzle. There is no built in tank. It can be used for spraying trees and tall field crops. It covers about 1.5 to 2 hectares of area in a day.

5. Foot Sprayer or Pedal Pump:

A pedal pump consists of a vertical pressure chamber mounted on to a stand and a plunger assembly with the plunger rod attacked to a pedal in addition to a suction hose with a strainer, a delivery hose with an extension rod and spray nozzle. It has no built in tank. It works on the same principle as the rocker sprayer except that the pedal is worked up and down by foot in this case where the rocker in a rocker sprayer is operated forward and backward by hand. In both cases continuous operation of pedal or rocker is required to maintain high pressure for uniform spraying. It is used for spraying agricultural crops as well as small fruit trees. About 1 to 1.5 ha area can be sprayed in a day.

B) Manually Operated Pneumatic Sprayers:

In the sprayer working with air compression system, the pressure is developed on the air contained in the spray tank, hence some air should be allowed to remained in the tank which therefore, should not be filled with spray fluid completely. They do not have agitators and hence are not useful spraying materials which settle down quickly.

1. Hand Sprayer or Ganesh Pump or Atomizer:

The container for the spray fluid also acts as the pressure chamber. An air pump attacked to the chamber projects inside. The inner end of the discharge pipe runs down to the bottom of the container and its outlet terminates in a nozzle. The tank is filled about 3/4th of it and the pump is worked force air into the space to build sufficient pressure upon the spray fluid. These sprayers are used extensively in kitchen gardens, in glasshouses and in doors against house-hold insects. The capacity of tank is up to one liter, if used in field it can cover an area of 0.1 ha in a day.

2. Knapsack Sprayer:

They are adopted for spraying large quantities of liquids. It comprises a tank for holding the spray as well as compressed air, a vertical air pump with a handle, filling hole with a strainer, spray lance with nozzle and release and shut-off devices. The tank is provided a convenient rest with the back of the operator and has shoulder straps that allow it to be carried by him. These sprayers are used against agricultural pests and mosquito control operations. The capacity of tank is 12 to 16 liters. This pump covers an area of about 0.8 to 1.2 ha in a day.

C) Power Operated Hydraulic Sprayer:

A power operated hydraulic sprayer generally consists of a petrol engine and a framework. The following are some of the power operated hydraulic sprayer.

1. Stretcher sprayer
2. Wheel-barrow sprayer
3. Traction sprayer
4. Power take off sprayer

D) Power Operated Pneumatic Sprayers:

It consists of the following sprayers

1. Portable sprayers
2. Traction sprayers

II) Low Volume Sprayers:

Since in these sprayers the spray fluid is atomized with the help of an air stream at high velocity, they are called mist blowers or power sprayers. The tank in these is made of a thick polyethylene and has a capacity of 10 liters. The fuel tank capacity is 1.0 to 1.5 liters. It is provided with 1.2 to 3.0 hp petrol engine. This can also be used for dusting provided suitable accessories. The area covered by these sprayers is about 2 ha in a day.

III) Ultra Low Volume Sprayers:

The pesticide in ULV formulation is used undiluted at a quantity less than 6 liters/ha and usually at 0.5 to 2.0 liters/ha for field crops. The droplet size varies from 20-150 micron with ground spraying equipment for ULV spray an area of 5 ha can be covered in a day. E.g. Controlled Droplet Applicator (CDA)

Uses of spraying and dusting equipments

- The spraying and dusting equipments are used for the following purposes
- For the insecticides application to control insect pests on crops and in stores, houses, kitchen, poultry farms, barns, etc.
- For the insecticides application to control insect pests on crops and in stores, houses, kitchens, poultry farms, barns, etc.
- For the acarices application to control phytophagous mites.
- For the fungicides and bactericides application to control the plant diseases.
- For the herbicides application, to kill the weeds.
- For the harmone sprays application to increase the fruit set or to prevent the premature dropping of fruits.
- For the application of plant nutrients as foliar spray.
- For applying the powdery formulation of poisonous chemicals on the crops and for any other purposes.

A power sprayer can be used as a power duster by making the following changes.

- Chemical filler cap is removed to dismantle that strainer with the air pipe.
- The liquid delivery pipe below the chemical tank is dismantled and removed with the shear nozzle.
- The tank is thoroughly cleaned to remove possible traces of moisture left inside.
- The dust agitator tube is fixed at the bottom of the chemical tank.
- This tube has holes at the bottom to prevent the entry of dust into the agitator and clogging it.
- Dust intake tube is inserted into the chemical tank at the discharge and this tube has no. of large size holes on its periphery.

- Dust intake tube and the blower elbow are connected by using the dust outlet pipe, which is a pleated hose.