

## **FORAGE PLANT PROTECTION TECHNOLOGIES**

### **HOT SPOTS/ENDEMIC AREAS/PROGRAMME:**

The All India Coordinated Research Project on Fodder Crops, with its 21 centres covering all the major agro-climatic situations of the country, is engaged in research on all the facets of technology development relating to forage crops. As a result wide range of germplasm material of various fodder crops has been collected and maintained at one or the other centres, such collections provides an excellent opportunity for screening the material for selection and breeding for resistance to major insects, diseases and nematodes.

For effective screening the locations which are subject to chronic outbreaks of one or more pests are useful. These locations are termed as “Hot spots”. Multi locational screening offers reliable information on the overall resistance of a germplasm genotype or an entry to the co-ordinated trials for a given disease or pest under field conditions. During last one decade attempts have been made to collect information regarding pest situations, entries and germplasm reaction to pests at certain selected locations of the project. The area endemic to each to each of the major pest has been identified. These information are based on the on spot field visits, surveys, personal/group discussions, infested, soil, plant material examination and correspondence (Table 1).

**Table 1: Hot Spot of insect pest and diseases infecting major forage crops**

<b>Crop</b>	<b>Pest or Diseases</b>	<b>Endemic area</b>	<b>Area</b>
<b>Berseem</b>	Pod borer Root rot complex Stem rot	Haryana, H.P. and Punjab Gujarat, Haryana, H.P., M.P., Punjab and U.P. H.P., Punjab and U.P.	Hisar, Ludhiana and Palampur Anand, Jabalpur, Jhansi, Ludhiana and Palampur Jhansi, Ludhiana and Palampur
<b>Cowpea</b>	Anthracnose Aphid Bacterial blight Cercospora leaf-spot CPMV Root rot Rust Septoria leaf Spot Stemfly	Karnataka A.P., Karnataka and Tamilnadu H.P., M.P. and U.P. Delhi, Haryana, Punjab and U.P. Gujarat, M.P. and U.P. H.P. and U.P. Karnataka Karnataka Karnataka	Dharwad and Raichur Coimbatore, Hyderabad and Tiptur Palampur and Pantnagar Hisar, Jhansi and Ludhiana Anand, Jabalpur and Jhansi Jhansi, Palampur and Pantnagar Dharwad and Raichur Dharwad and Raichur Raichur
<b>Lucerne</b>	Alfalfa weevil Aphids Downy mildew Rust	Punjab, Haryana and U.P. Gujarat, Haryana, Maharashtra, Punjab and U.P. Gujarat, Haryana, Maharashtra and U.P. Gujarat and Maharashtra	Hisar, Jhansi and Ludhiana Anand, Hisar, Coimbatore, Ludhiana and Rahuri Anand, Jhansi, Hisar, Pantnagar and Urulikanchan Anand and Urulikanchan
<b>Maize</b>	Downy mildew Maydis leaf spot Shootfly Stem borer Tucicum leaf-spot Whitegrubs	Karnataka, Rajasthan and Tamilnadu Indo-gangetic plains and Rajasthan Indo-gangetic plains Nothern plains and Pennisular India Himalya region and During rabi in pennisular India Northern plains	Dharwad, Durgapura and Coimbatore Durgapura, Ludhiana and Pantnagar Jhansi and Pantnagar Hyderabad, Durgapura, Ludhiana and Pantnagar Almora, Dharwad and Hyderabad Durgapura and Ludhiana

<b>Pearl millet</b>	Blast	Haryana, Rajasthan and U.P. A.P., Haryana, Maharashtra, Rajasthan and Tamilnadu	Hissar, Durgapura and Jhansi Coimbatore, Hisar, Hyderabad, Durgapura and Jhansi
	Downy mildew		
	Rust	A.P., Karnataka and Maharashtra	Coimbatore, Dharwad, Hyderabad and Urulikanchan
	Whitegrubs	North-Gujarat and Rajasthan	Durgapura
<b>Sorghum</b>	Anthracnose	All over India	All the centres
	Blight	Karnataka, Maharashtra, M.P. and Tamilnadu	Coimbatore, Dharwad, Jabalpur and Urulikanchan
	Downy mildew	A.P., Karnataka, Maharashtra and Tamilnadu	Coimbatore, Dharwad, Hyderabad and Urulikanchan
	Rust	A.P., Karnataka, Maharashtra and Tamilnadu	Coimbatore, Dharwad, Hyderabad and Urulikanchan
	Shootfly	A.P., Karnataka, Maharashtra and Tamilnadu	Coimbatore, Dharwad, Hyderabad and Urulikanchan
	Sooty stripe	A.P., Karnataka, Maharashtra, Tamilnadu and U.P.	Jhansi, Hissar and Jabalpur
	Stem borer	Haryana, M.P. and U.P.	Hyderabad, Jabalpur and Jhansi
Zonate leaf spot	A.P., M.P. and UP	Hissar, Jabalpur, Jhansi, Hyderabad, Ludhiana and Urulikanchan	
	A.P., Haryana, Karnataka, Maharashtra, M P and Punjab		

### Major pests and diseases of important forage crops

Pests and diseases have been listed on the basis of their economic importance. Some specific insects and diseases infecting a particular forage crop seems to have a limited endemic areas, whereas others are widely distributed for example intensity of anthracnose, rust, Septoria leaf spot diseases and stem fly of cowpea was found to be more in Karnataka only. Moreover, if there are more than one insect of disease are important on a specific crop their endemic area may vary. In case of lucerne both weevil and aphid is important insect pest, but the later one is more important in Gujarat. Downy mildew cause damage to a number of crops like lucerne, maize, pearl millet and sorghum is widely distributed in southern region of the country. Unlike insects, fungi, bacteria, viruses and nematodes are distributed throughout the country and would be difficult to classify them as real hot spots (table 2).

**Table 2: Major pests of important fodder crops**

<b>Berseem (<i>Trifolium alexandrinum</i>)</b>	
<b>Root rot complex</b>	<i>Rhizoctonia solani, Fusarium semitactum, Tylenchorhynchus vulgaris</i>
<b>Stem rot</b>	<i>Sclerotinia trifoliorum</i>
<b>Pod borer</b>	<i>Helicoverpa armigera</i>
<b>Stunt nematode</b>	<i>Tylenchorrhynchus vulgaris, T.mashhoodi</i>
<b>Cowpea (<i>Vigna unguiculata</i>)</b>	
<b>Root rot</b>	<i>Macrophomina phaseolina</i>
<b>Mosaic disease</b>	Cowpea mosaic virus
<b>Flea beetles</b>	<i>Pagria signata</i>
<b>Semilooper</b>	<i>Plusia nigrisign</i>
<b>Leaf hoppers</b>	<i>Empoasca kerri</i>
<b>Root knot nematode</b>	<i>Meloidogyne incognita</i>
<b>Reniform nematode</b>	<i>Rotylenchulus reniformis</i>

<b>Pigeon pea cyst nematode</b>	<i>Heterodera cajani</i>
<b>Lucerne (<i>Medicago sativa</i>)</b>	
<b>Downy mildew</b>	<i>Peronospora trifolii</i>
<b>Rust</b>	<i>Uromyces striatus</i>
<b>Common leaf spot</b>	<i>Pseudopeziza medicagenis</i>
<b>Lucerne weevil</b>	<i>Hypera postica</i>
<b>Aphids</b>	<i>Acyrtosiphon pisum</i> and <i>Theriophis trifolii f. maculata</i>
<b>Stem nematode</b>	<i>Ditylenchus dipsaci</i>
<b>Lesion nematode</b>	<i>Pratylenchus penetrans</i>
<b>Root-knot nematode</b>	<i>Meloidogyne spp.</i>
<b>Clover cyst nematode</b>	<i>Heterodera trifolii</i>
<b>Guar (<i>Cyamopsis tetragonoloba</i>)</b>	
<b>Bacterial blight</b>	<i>Xanthomonas campestris pv. cyamopsidis</i>
<b>Yellow mite</b>	<i>Polyphagotarsoemus latur</i> and <i>P. datus</i>
<b>Root knot nematode</b>	<i>M. incognita</i>
<b>Reniform nematode</b>	<i>Rotylenchulus reniformis</i>
<b>Stylos (<i>Stylosanthes guianensis</i>)</b>	
<b>Anthraxnose</b>	<i>Colletotrichum gloesporioides</i>
<b>Root rot</b>	<i>Sclerotium rolfsii</i>
<b>Clitoria (<i>Clitoria ternatia</i>)</b>	
<b>Root knot nematode</b>	<i>M. incognita</i>
<b>Sorghum, Maize and Bajra (<i>Sorghum bicolor</i>, <i>Zea mays</i> and <i>Pennisetum typhoides</i>)</b>	
<b>Anthraxnose</b>	<i>Colletotrichum graminicola</i>
<b>Sooty stripe</b>	<i>Ramulisporia sorghi</i>
<b>Zonate leaf spot</b>	<i>Gloeocercospora sorghi</i>
<b>Downy mildew</b>	<i>Scleropsora sorghi</i>
<b>Shoot fly</b>	<i>Atherigona varia soccata</i>
<b>Stem borer</b>	<i>Chilo partellus</i>
<b>Aphids</b>	<i>Rhapalosiphum maidis</i>
<b>Sorghum mildge</b>	<i>Contarinia sorghicola</i>
<b>Army worm</b>	<i>Mythimna separata</i> , <i>Spodoptera exigua</i>
<b>Sorghum cyst nematode</b>	<i>Heterodera sorghi</i>
<b>Maize cyst nematode</b>	<i>H. zae</i>
<b>Stunt nematode</b>	<i>Tylenchrhynchus spp.</i>
<b>Lesson nematode</b>	<i>Pratylenchus spp.</i>
<b>Oats (<i>Avena sativa</i>)</b>	
<b>Leaf blotch</b>	<i>Helminthosporium avenae</i>
<b>Crown rust</b>	<i>Puccinia coronata</i>
<b>Stem rust</b>	<i>Puccinia graminis avena</i>
<b>Sclerotial wilt</b>	<i>Sclerotium rolfsii</i>
<b>Aphids</b>	<i>Rhapalosiphum maidis</i>
<b>Cyst nematode</b>	<i>Heterodera avenae</i>
<b>Range grasses</b>	
<b>Rust</b>	<i>Puccinia</i> and <i>Uromyces spp.</i>
<b>Leaf spots</b>	<i>Phylohora</i> , <i>Curvularia</i> , <i>Pyricularia</i> , <i>Scrossporium</i> , <i>Colletotrichum</i>

	<i>spp.</i>
<b>Grasshoppers</b>	<i>Hieroglyphus nigrorepletus, Catantops pinguis, Oedaleus abruptus, Chrotogonus trachypterus, Aelopus tamulus, Colemania sp., Oxya sp., Locusta migratoria, Attractomorpha sp.</i>
<b>Cyst nematode</b>	<i>Heterodera avenae, H.sorghii, H.zeae, H.mothi, H.graminis, H.cyperii, H.saccharii, H.delvi</i>
<b>Root-knot nematode</b>	<i>Meloidogyne spp.</i>
<b>Seed gall nematode</b>	<i>Anguina spp.</i>
<b>Lesion nematode</b>	<i>Pratylenchus spp.</i>
<b>Stunt nematode</b>	<i>Tylenchorhynchus spp.</i>
<b>Lance nematode</b>	<i>Hoplolaimus spp.</i>
<b>Spiral nematode</b>	<i>Helicotylenchus spp.</i>
<b>Soo-babool (<i>Leucaena leucocephalla</i>)</b>	
<b>Gumosis</b>	<i>Fusarium solani</i>
<b>Pink disease</b>	<i>Corticium salamanicolor</i>
<b>Psyllids</b>	<i>Heteropsylla cubana</i>

## TECHNOLOGIES

1. Collar rot and Powdery mildew of white clover (*Trifolium repens*) can be effectively managed by seed treatment with *Trichoderma* @5g/kg and alternate spray Cantaf and Karathane @0.5% at 15 days and 7 days interval
2. Root and stem rot disease of cowpea – Seed treatment with Thiram (0.25%) + Carbendazim (0.2%)
3. Seed treatment with *Trichoderma viride* +neem cake 40 g/ha
4. Seed treatment with *Trichoderma viride* + FYM ( @ 4 t/ha) amending in soil
5. Sucking pest and yellow mosaic virus in seed crop –spraying of Imidacloprid 17.8 SL @ 0.3 ml/l at 15 days interval and *Verticillium leccani* @5 g/l at 10 days interval
6. Powdery mildew of Oat - Seed treatment with Vitavax @ 2.5 g/kg seed + *Trichoderma viridae* @ 5g/kg followed by foliar spray with propiconazol @ 0.01 %
7. In Berseem, soil treatment with carbofuran @ 3G@1g/m row along with seed treatment with carbendazim @ 1g/kg provides maximum forage yield (518.89 q/ha) but economically seed treatment with neem seed powder@ 50g/ kg has been found most viable (C:B 50.95) than the other treatments studied.

## SORGHUM + COWPEA Intercropping

*Trichoderma viride* @ 5g/kg seed + FYM @4 t/ha followed by NSKE @ 3% Spray

## IPM MODULE FOR LUCERNE SEED CROP

1. Spraying of *Bacillus thuringiensis* @1 kg/ha release of *T. chilonis* @100,000 parasites/week/ha synchronizing first release with the appearance of *H. armigera* larvae (minimum 2 release), spraying of HaNPV @ 250 LE/ha after last release of *T. chilonis*

and installation of 'T' shaped bird perches stands for birds @ 15 /ha recorded 34.6 per cent has been perfected. It results in increased seed yield of Lucerne over untreated control. The incremental cost benefit ratio of the IPM treatment was 5.24.

2. FYM (62.5kg/ha) + *Trichoderma* (2.5 kg/ha) provided 42.6 control –Hisar.
3. Seed soaking in salicylic acid (0.02%) + spray of salicylic acid (0.02%) provided best control of root knot –Palampur.
4. Seed treatment with neem seed powder @ 50g/kg had lowest root knot index.
5. Application of FYM (62.5kg/ha) + *Trichoderma* (2.5 kg/ha) provided maximum yield.
6. Neem seed kernal extract spray @ 3 % either alone or in combination with seed treatment with bio-control agents like *Trichoderma viridae* and *Paecilomyces lilacinus* @ 5g / kg or neem seed powder @50 g /kg seed in cowpea intercropped with sorghum / maize, reduced the pest, diseases and nematode incidence considerably and increased the fodder yield.