

# Annual Progress Report: 2016-17

## 3. Plant Pathology



## Annual Progress Report: 2016-17

### 3. Plant Pathology

#### Contents

<b>Executive summary .....</b>	<b>3</b>
<b>Detailed report .....</b>	<b>3</b>
<b>FM (PP) 300: Survey and surveillance for the incidence of diseases of finger millet- .....</b>	<b>3</b>
FM (PP) 301: Evaluation of germplasm .....	4
FM (PP) 301.1: Evaluation of IVT .....	5
FM (PP) 301.2: Evaluation of AVT I & II .....	5
<b>SM (PP) 300: Survey for the incidence of diseases of other millets .....</b>	<b>5</b>
SM (PP) 301.1: Evaluation of LAVT .....	5
SM (PP) 301.2: Evaluation of KAVT .....	5
SM (PP) 301.3: Evaluation of FAVT .....	5
SM (PP) 301.4: Evaluation of BAVT .....	5
SM (PP) 301.5: Evaluation of PAVT .....	6
<b>SM (PP) 302: Donor screening nursery (DSN) -.....</b>	<b>6</b>
SM (PP) 302.1: Evaluation of DSN little millet .....	6
SM (PP) 302.2: Evaluation of DSN kodo millet- .....	6
SM (PP) 302.3: Evaluation of DSN foxtail millet .....	6
SM (PP) 302.4: Evaluation of DSN barnyard millet.....	6
SM (PP) 302.5: Evaluation of DSN proso millet .....	6
<b>PP 401: Correlation studies of foliar diseases with weather parameters- .....</b>	<b>6</b>
<b>PP 501: Eco friendly Management of Banded blight/ Sheath blight of Small Millets .....</b>	<b>6</b>
<b>Plant pathology: Tables of experiments (Page nos. from 8 to 41) .....</b>	<b>7</b>

### 3. Plant Pathology

#### Executive summary

Most of the finger millet varieties grown across the country were improved varieties; consequently head blast pressure was low to moderate in Andhra Pradesh, Chattisgarh, Karnataka, Odisha and Tamil Nadu, whereas high blast prevailed on local varieties in Jharkhand and Uttarakhand. Brown spot and foot rot were low to moderate in Odisha and Tamil Nadu while cercospora leaf spot remained high in Uttarakhand. On foxtail millet blast, rust and downy mildew occurrence was low in Andhra Pradesh, whereas in Uttarakhand grain smut was low to high, but sheath blight was low on barnyard millet. In little millet grain smut and banded blight ranged from low to high; in kodo millet head smut, banded blight and *Striga* occurrence was of low to moderate intensity in Madhya Pradesh.

Among the germplasm, finger millet line VR-13-14 was immune to both neck and finger blasts at Almora, whereas at Mandya varieties GN 4, GN 5 and Dapoli 1 were not only immune to head blast, but were highly resistant to foot rot. At Almora ten IEC lines of barnyard millet were immune to grain smut. Out of the 1034 *Setaria* lines screened at Nandyal, though many were resistant, a total of 775 lines were free from both downy mildew and blast.

In finger millet IVT, BR 14-3 for blast and PR 10-35 for banded blight were highly promising, whereas in AVT I & II while no entry was superior for banded blight and CLS, VL 379 showed moderate resistance to neck blast. Five LAVT lines viz., KOPLM 53, GPUL 2, WV 126, DLM 95 and DHLT 28-4 were free from grain smut; KAVT entry DPS 118 was highly resistant to head smut whereas BAVT line DHBM 18-6 was resistant to grain smut. FAVT entries, SiA 3164 for brown spot and rust, DHFT 5-6 for rust and blast, H-4-6 for rust and downy mildew were resistant.

In correlation studies at Ranichauri, with increase in average temperature, the CLS severity decreased. Incidence of foxtail millet blast was negatively correlated with maximum temperature, but was positively correlated with minimum temperature, relative humidity (morning and evening) and rainfall, but, rust incidence was positively correlated with maximum temperature and relative humidity (morning and evening); at the same time it was negatively correlated with minimum temperature and rainfall.

In the eco-friendly management of banded/ sheath blight over locations and amongst different small millets, soil application of value added *P.f.+T.v.+B.s.* not only minimized disease, but also enhanced grain and fodder yields.

#### Detailed report

Coordinated trials on six small millets viz., finger millet, foxtail millet, kodo millet, little millet, barnyard millet and proso millet were conducted at 11 AICRP centers located in eight different states and a lone voluntary center at VPKAS, Almora (Uttarakhand). During the *khari* 2016, all the centers could implement the programme in Toto (Table 9).

**FM (PP) 300: Survey and surveillance for the incidence of diseases of finger millet**-Survey of disease/s is essential to monitor occurrence of different diseases vis-à-vis the extent to which it occurs. It also provides information on new disease/s noticed alongside the location and varieties affected for planning the breeding and management strategies.

**Jagdalpur**- Moderate occurrence of blast was seen in surveyed areas both on local as well as improved varieties of finger millet (Table 1.1).

**Ranchi**- Varieties A-404 and BBM-10 were resistant as compared to local as well as other improved varieties like BM-2 and JWM-1 (Table 1.2).

**Bengaluru**- Surveyed areas of Kolar district revealed that varieties GPU 28 & ML- 365 had low to moderate blast disease (Table 1.3).

**Mandya**- Local varieties of finger millet recorded high finger blast whereas improved varieties like GPU 28, KMR 204 and MR 6 were resistant (Table 1.4).

**Berhampur**- Apart from varying levels of blast disease recorded on different local and improved varieties of finger millet, moderate incidence of brown spot was also seen. Foot rot up to 20 % was also recorded on different varieties (Table 1.5).

**Athiyandal**- Neck and finger blast to the tune of up to 12% and leaf blast and brown spots of 0-3 G were recorded on different varieties of finger millet grown in Tamil Nadu (Table 1.6).

**Ranichauri**- Moderate to severe incidence of blast was noticed on local as well as improved varieties of finger millet, besides CLS of 6-8 G was also recorded on most of the improved varieties (Table 1.7).

**Vizianagaram**- Varieties of finger millet cultivated in major areas were Sri Chaithanya and Bharathi (Table 1.8) that revealed low leaf blast (1-2 G) and moderate neck and finger blasts (~ 6-15%).

**FM (PP) 301: Evaluation of germplasm**- Besides collection, evaluation of local germplasm is very essential to locate sources of resistance to diseases endemic to the area. In this background 45 lines of finger millet were screened for resistance to blast; while VR-13-14 was immune to head blast, several other lines were also highly resistant at Almora (Table 2.1).

At Mandya, a set of 36 finger millet varietal collections were evaluated against blast and foot rot diseases. Few lines viz., GN 4, GN 5 and Dapoli-1 were immune for neck and finger blasts, majority of the lines showed resistant reaction against foot rot also (Table 2.2).

At Vizianagaram, 16 barnyard millet lines along with two checks were evaluated for resistance to banded blight and none proved superior (> 70% disease), whereas at Almora 10 lines viz., IEC 516, 543, 535, 342, 549, 756, 540, 549, 545 and 538 were immune to grain smut (Table 2.3).

A set of 24 foxtail millet lines along with two checks were screened to major diseases at Ranichauri, while all the lines were resistant to immune for rust; they were moderately resistant to both blast and brown spot diseases (Table 2.4). Out of the 10 proso millet entries collected from Tamil Nadu and evaluated for resistance to banded blight and brown spot, while all were free from banded blight, but were susceptible to brown spot (Table 2.5).

Performance evaluation of entries under different coordinated trials across AICRP centers has been mandatory to know their reaction to major diseases endemic to the region or state. In this background, entries of finger millet under IVT and AVT (E&M) were evaluated at 11 centers. The blast which is the most important disease of the crop was low at Almora, Bengaluru, Mandya and Ranchi; moderate at Athiyandal, Jagdalpur and Ranichauri and high at Berhampur and Vizianagaram centers. Foot rot pressure was low at Jagdalpur, moderate at Mandya and high at Berhampur. Cercospora leaf spot at Ranichauri was high, whereas banded blight an emerging problem of millets was low at Jagdalpur, but was high both at Ranchi and Vizianagaram.

**FM (PP) 301.1: Evaluation of IVT-** A set of 18 finger millet entries were evaluated for resistance to major diseases at nine centers viz., Almora, Athiyandal, Bengaluru, Berhampur, Jagdalpur, Mandya, Ranichauri, Ranchi and Vizianagaram. Amongst them while BR 14-3 was resistant to leaf blast it was moderately resistant to head blast. Few other cultures viz., GPU 94, GPU 93, DHFM 78-33 were moderately resistant to neck blast disease. Cultures GPU 94, VR 1094, KOPM 942, KRI 009-04 and checks GPU 67, VL 352 and PR 202 were resistant to foot rot, but only one culture PR 10-35 was resistant to banded blight. However, no entry was resistant to brown spot and CLS but majority were moderately resistant to both the diseases (Table 3.1).

**FM (PP) 301.2: Evaluation of AVT I & II-**Both test cultures of early and medium maturity group VL 386 and VL 379 screened for resistance at 11 centers viz., Almora, Athiyandal, Bengaluru, Berhampur, Dindori, Jagdalpur, Mandya, Ranichauri, Ranchi, Rewa and Vizianagaram were only moderately resistant to leaf as well as finger blast, but VL 379 was moderately resistant to neck blast; whereas VL 386 was moderately susceptible. However, no culture holds promise against banded blight and CLS. Both were moderately resistant to foot rot and brown spot diseases (Table 3.2).

### **SM (PP) 300: Survey for the incidence of diseases of other millets**

**Nandyal-** Krishnadevaraya, Suryanandhi and Srilaxmi were the predominant foxtail millet varieties that were resistant to both blast & rust diseases. However leaf shredding was seen to the tune of 5.5% on Krishnadevaraya and Suryanandhi (Table 4.1).

**Rewa-** Grain smut and sheath blight in the range of 0-40% were recorded with a mean of 7.0 and 18.8 per cent respectively in little millet (Table 4.2).

Head smut in the range of 0.0 to 6.5% (mean of 2.4%) and sheath blight in the range of 0-30% (mean 10.2%) was recorded in kodo, but *Striga* infestation ranged from 0.0 to 12% (Table 4.3).

**Ranichauri-** while PRJ-1 was immune to both grain and head smuts, local varieties showed up to 37% grain smut. Head smut though was not major was seen up to 12% in VL 207 whereas sheath blight was low to moderate and ranged from 0-5 G (Table 4.4).

**SM (PP) 301.1: Evaluation of LAVT-** By mean performance over five locations viz., Berhampur, Jagdalpur, Ranchi, Rewa and Vizianagaram no entry was resistant to banded blight, but five cultures KOPLM 53, GPUL 2, WV 126, DLM 95 and DHLT 28-4 besides the checks OLM 203 and BL 6 were free from grain smut disease both at Jagdalpur and Rewa. TNPsu 171 and GPUL 2 were resistant to brown spot disease (Table 5.1).

**SM (PP) 301.2: Evaluation of KAVT-**For head smut the most important production constraint of the crop, DPS 118 was highly resistant across four locations viz., Bengaluru, Dindori, Jagdalpur and Rewa, but no entry was promising to banded blight an emerging problem of the crop. However many cultures were resistant to moderately resistant for leaf blight (Table 5.2).

**SM (PP) 301.3: Evaluation of FAVT-** While no culture was promising against banded blight, entries SiA 3179 and SiA 3164 for brown spot; SiA 3205 and DHFT 5-6 for leaf blast; SiA 3205, DHFT 5-6, H 46 and SiA 3164 for rust whereas RFM 68, DHFTMV 2-5, SiA 3163, H-46, SiA 3159, DHFT 5-6 and DHFT 77-3 were resistant to leaf shredding (Table 5.3).

**SM (PP) 301.4: Evaluation of BAVT-** While DHBM 18-6 (Table 5.4) was resistant to grain smut (across four locations viz., Almora, Bengaluru, Ranichauri, Rewa) as well as leaf blight (at Athiyandal, Bengaluru, Ranichauri), no culture was promising against banded blight (Rewa, Vizianagaram).

**SM (PP) 301.5: Evaluation of PAVT-** Ten entries of proso millet were evaluated for reaction to major diseases at Athiyandal, Ranichauri and Vizianagaram. While none hold promise to banded blight, majority of the cultures were moderately resistant to brown spot disease (Table 5.5).

**SM (PP) 302: Donor screening nursery (DSN)** - Identification of resistant source to major diseases of a crop is essential to generate information on lines showing multiple disease resistance. In this background selected cultures of kodo millet, little millet, foxtail millet, barnyard millet and proso millet were screened at different locations for reaction to major diseases to locate sources with multiple disease resistance for use as donors.

**SM (PP) 302.1: Evaluation of DSN little millet-** Out of the 30 test entries, while TNAU 163 (2%) was resistant JK 36 (7%) was moderately resistant to banded blight in three locations Ranchi, Rewa and Vizianagaram. For brown spot, grain smut and leaf blast many cultures were immune and of them TNPSu 201, 202, 203, 204, 205, 206, 207 and 208 were immune to all three diseases at Athiyandal, Rewa and Ranichauri centers respectively (Table 6.1).

**SM (PP) 302.2: Evaluation of DSN kodo millet-** Entries BK 5 and JK 137 with < 10% disease were moderately resistant to banded blight by mean performance over three locations viz., Dindori, Jagdalpur and Rewa, but as regards head smut 12 cultures with < 5% disease were promising and of them KOPN 10, TNAU 86, RK 390-25 and JK 137 were highly resistant (Table 6.2).

**SM (PP) 302.3: Evaluation of DSN foxtail millet-** Most of the test cultures revealed moderately resistant reaction to blast at Rewa, but none was promising against banded blight disease either at Rewa or at Vizianagaram center (Table 6.3).

**SM (PP) 302.4: Evaluation of DSN barnyard millet-** A set of 18 entries was screened and that no entry was promising for banded blight at Rewa. VL 172 was immune to brown spot and resistance to grain smut diseases at Ranichauri (Table 6.4).

**SM (PP) 302.5: Evaluation of DSN proso millet-** None of the ten test entries were resistant to banded blight at Vizianagaram center (Table 6.5).

**PP 401: Correlation studies of foliar diseases with weather parameters-** Correlating meteorological parameters with the occurrence of foliar disease/s is useful in planning sowing time and alerting farmers on need based sprays.

In case of cercospora leaf spot, as average temperature increased, the CLS severity decreased at Ranichauri (Table 7.1). Incidence of foxtail millet blast was negatively correlated with maximum temperature, but was positively correlated with minimum temperature, relative humidity (morning and evening) and rainfall. However, rust incidence was positively correlated with maximum temperature and relative humidity (morning and evening); at the same time it was negatively correlated with minimum temperature and rainfall (Table 7.2).

**PP 501: Eco friendly Management of Banded blight/ Sheath blight of Small Millets-** Banded blight caused by *Rhizactonia solani* has been on the rise in most of the small millets especially on the research farms at Vizianagaram, Rewa, Jagdalpur, Ranchi and Ranichauri. As no released variety is resistant to this disease and chemicals for soil borne pathogens in millets (low returns) are not economical it was necessitated for managing the disease through eco-friendly means particularly through the application of bio agents. Buildup of the bio agents in infected soils may be very helpful in gradual reduction of the pathogen population and consequently less disease.

**Finger millet:** At Vizianagaram, soil application of value added bio-agents viz., *P.f.+T.v.+B.s.* recorded least disease (11%) that was comparable to soil application of *T.v.* alone (12%) as against 54% in untreated check plots. Both grain and fodder yields were highest with 1272 and 4719 kg/ha and 1236 and 4506 kg/ha

respectively. Soil application of at least *T.v.* @ 1 kg in 25 kg FYM will minimize banded blight and result in higher grain and fodder yields (Table 8.1).

**Foxtail millet:** Least banded blight and highest grain and fodder yields of 24%, 1142 kg and 2169 kg/ha respectively were obtained at Vizianagaram in soil application of value added *P.f.+T.v.+B.s.* that was superior over rest of the treatments (Table 8.2).

**Proso millet:** Similar results of least banded blight (15%) and higher grain (209 kg) and fodder yields (1806 kg/ha) were recorded in the treatment involving soil application of value added *P.f.+T.v.+B.s.* as against 66% disease, 122 kg grain and 908 kg fodder yields per hectare in check plots at Vizianagaram (Table 8.3).

**Kodo millet:** The management trial conducted at three locations Jagdalpur, Rewa and Vizianagaram revealed that, by mean performance soil application of value added *P.f.+T.v.+B.s.* recorded the least incidence of banded blight (25%) besides highest grain (2316 kg) and fodder yield (4616 kg/ha) as seen from Table 8.4.

**Barnyard millet:** Mean over two locations Ranichauri and Vizianagaram revealed that soil application of value added *P.f.+T.v.+B.s.* though recorded the least banded blight (18%) highest grain yield was obtained with soil application of *T.v.* alone which was on par with yields from combined application of value added *P.f.+T.v.+B.s.* However, highest fodder yield of 2472 kg/ha was recorded from the combined application treatment (Table 8.5).

**Little millet:** By mean performance over three locations viz., Ranchi, Rewa and Vizianagaram, soil application of value added *P.f.+T.v.+B.s.* not only recorded least banded blight of 28% but also resulted in highest grain and fodder yields of 671 kg and 3800 kg/ha respectively. This was comparable with application of either *T.v.* or *P.f.* alone (Table 8.6).

#### Contributors for Small Millets pathology

S. No.	Details
1	Dr. A. Nagaraja, Professor & PI, PC Unit (Small Millets), ICAR, GKVK, Bengaluru-560 065 (KA)
2	Dr. A. K. Jain, Pathologist (Small Millets), College of Agriculture, Rewa – 486 001 (M.P.)
3	Dr. T. Samuel S K. Patro, Pathologist, Agriculture Research Station, Gajularega, Vizianagaram – 535 001. (A.P.)
4	Dr. Mrs. Savitha Ekka, Jr. Pathologist (Small Millets), AICRP on Small Millets, Birsa Agricultural University, Kanke, Ranchi – 834 006 (JH)
5	Dr. S.C. Yadav, Jr. Pathologist, S.G. College of Agriculture & Research Station, Kumharwand Farm Jagdalpur-494 005 (CG)
6	Sri H.R. Raveendra, Jr. Pathologist (Small Millets), ZARS, V.C. Farm, Mandya – 571 405 (KA)
7	Dr. Mrs. Lakshmi Rawat, Jr. Pathologist (Small Millets), VCSG Uttarakhand Univ. of Hort. & Forestry Ranichauri – 249 199 (U.K.)
8	Dr. M. Rajesh, Asstt. Prof. of Plant Pathology, Centre of Excellence in Millets, Athiyandal – 606 603, Thiruvannamalai dist. (T.N.)
9	Dr. S. Saralamma, Pathologist, Regional Agril. Research Station, Nandyal– 518 503 (A.P.)
10	Dr. Sangita Bal, Jr. Pathologist (Small Millets) I/c, OUAT (ARS), Berhampur -761 001 At Post: Krupasindhupur , Via: Nimakhandi , Dist: Ganjam (OD)
11	Dr. H. Rajashekhar, Scientist (Pathology), VPKAS, Almora – 263 601, (U.K.)
12	Dr. Suresh Patil, Research Associate (Plant Pathology), PC Unit (Small Millets), Bengaluru-560 065

#### Plant pathology: Tables of experiments (Page nos. from 8 to 41)