

is also being used for fingerprinting of the pathogen.

Bruchid management in groundnut: Among the four types of storage bags tested for storability and management of bruchid (*Caryedon serratus*), the super-grain bag was found significantly superior over other storage bags, and recorded minimum number of eggs laid (216.1); damage to pods (38%) and kernels (34%) and weight loss in pods (38%) and kernels (34%). The super-grain bags have been recommended for a storage period of four months. Among the four botanical oils (neem, pongamia, castor and eucalyptus) against bruchid (*Caryedon serratus*) in storage, neem (10% v/w) oil treated groundnut pods were found with lowest

Commercial crops

Rapid delivery of fungicides to manage sugarcane diseases: A mechanized sett treatment unit has been developed for rapid delivery of fungicides on sugarcane setts to manage red rot, smut and wilt; the major fungal diseases of sugarcane. The validated results for the efficacy of fungicide delivery revealed that sett treatment with fungicides by the new device effectively reduced red rot and smut from primary sources of fungal inocula. This approach reduced sett treatment time and economized fungicides in terms of quantity and cost. In the long run, this strategy will lead to effective

CROP MANAGEMENT



management of major fungal diseases such as red rot and smut in sugarcane.

Endophytic *Beauveria bassiana* reduced stem

5 min, followed by incubation at 60°C for 25 min and the lysate was used as PCR template.

Based on the type of tissues, the composition and

Taiwan; **viruses**, *Bean pod mottle virus* and *Tomato ringspot virus* on cowpea from Nigeria and Italy and *Peanut stunt virus* and *Pea enation mosaic virus* from Italy, *High plains virus* on transgenic maize, and *Bean mild mosaic virus*, *Cherry leaf roll virus* and *Cowpea severe mosaic virus* on transgenic soybean from the USA; **nematodes**, *Aphelenchoides besseyi* on paddy from Bangladesh, China, Philippines and the USA, *Meloidogyne* spp. and *Pratylenchus* sp. from rooted saplings of black locust from Hungary; **insects**, *Cryptolestes ferrugineus* on wheat from Mexico and on cabbage from the Netherlands, *Tribolium castaneum* on barley from Morocco and on paddy from China, *Sitophilus granarius* on paddy from China, *S. zeamais* on maize from Egypt and Philippines, *S. granarius* from Thailand, *Chalcid* seed wasp on tomato from the USA and mites on garlic from Israel; and among **weeds**, *Avena barbata*, *Buglossoides arvensis*, *Centaurea melitensis*, *Echium plantagineum*, *Fallopia convolvulus* on barley from Morocco.

Cereals

per 100) caused 75-79% mortality of *R. reniformis*



Mechanized Sett Treatment Device

preadults. Application of *L. sphaericus* was evaluated as seed treatment on *R. reniformis* under pot conditions. In split-root experiments, *L. sphaericus* on roots protected plants from reniform nematode through induction of systemic acquired resistance (SAR).

Rice root-knot (*Meloidogyne graminicola*) in rice, guava and pomegranate has recently emerged as a major problem in the country. The disease is spreading through nurseries in rice and through infected planting materials



Pokkah boeng disease of sorghum—Grades on a scale of 0-4

against *F. subglutinans*. This technique could be utilized for screening genotypes for pokkah-boeng resistance.

Commercial crops

Effective fungicidal treatment to sugarcane setts: A mechanized sett treatment device has been developed for effective delivery of nutrients, fungicides and insecticides for pest and disease management in sugarcane nursery. Fungicidal treatment of sugarcane setts reduced red rots and smut infection effectively in sugarcane. The technology has been commercialized and recommended for use in nurseries and sugar industry.

Rapid detection of Tobacco Streak Virus (TSV) on cotton and soybean

by fumigation with Metam sodium at 50 ml/m³ under polythene mulch for 15 days + neem-cake 200 g/m² + *Pseudomonas fluorescens* at 50 g/m² (mixed 15 days prior to transplanting tomato/cucumber) reduced nematodes by 80%, root galling by 51%, and increased yield by 49% in tomato. Newer chemicals like Nimitz and Fluopyram have given good results for nematode management.

Integrated pest management

Validation of IPM on rice fields: A protocol of IPM was validated on rice-crop cv. Pusa Basmati 1121 in 350 hectares in farmers' participatory mode in cluster

New molecules to control *Rhizoctonia solani* and *Sclerotium rolfsii*

New chemical molecules of halogenated Schiff bases were synthesized and screened for anti-fungal bioassay against *Rhizoctonia solani* and *Sclerotium rolfsii*. Among the screened compounds, N-propyl-3, 5-dichloro-2-hydroxyl acetophenonimine was found most active against both the fungi. Whereas two naturally occurring isoflavones viz. genistein and biochanin A, and their dihydro derivatives (isoflavanones) as well as nine perhydrogenated isoflavones (isoflavans) showed high antifungal activity. Genistein isoflavan and isoflavans with two hydroxyl groups and one methoxy group proved highly fungitoxic.

Bioformulations for biocontrol

A number of bioformulations of biocontrol agents *Pseudomonas fluorescens*, *Trichoderma harzianum* and *T. viride* namely **Eco-Pesticide** (Talc-based bioformulation of *P. fluorescens*); **Green Fungicide** (Talc-based bioformulation of *T. harzianum*) and **Bio Pulse** (fly-ash based bioformulation of *Trichoderma harzianum* and *Bacillus amyloliquifaciens*) were developed and validated for their efficacy against a number of soil and seed-borne pathogens. These formulations effectively controlled diseases caused by *Rhizoctonia*, *Sclerotium*, *Sclerotinia*, *Fusarium*, *Pythium*, *Ralstonia*, *Macrophomina*, *Bipolaris*, *Phoma*, etc.



Microbe-based biocontrol agents; A-C= bioformulations, D= control f... and with Bio Pulse



A SCIENCE AND TECHNOLOGY NEWSLETTER

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PROMISING TECHNOLOGIES**Sett way of growing sugarcane for fungal treatment**

Owing to practical difficulties in handling voluminous planting material (setts) in sugarcane, the increased duration of fungicide treatment, although effective to manage important fungal diseases could not be practiced.

To address this issue, a modified fungicide treatment through low pressure diffusion technique in a short duration of treatment

To address this issue, a modified fungicide treatment through low pressure diffusion technique in a short duration of treatment was evolved with a lab prototype at ICAR-SBI, Coimbatore. The prototype was validated for sett treatment with fungicides and microbes (*Pseudomonas fluorescens*, *Azospirillum*, *Glucanoacetobacter* and *Phosphobacterium*) for disease management and growth promotion. During the evaluation for various inputs, the results on tissue bioassay, green house and field experiments indicated that the uptake and efficacy of fungicides/microbes was found to be similar for both the methods of treatment



PROMISING TECHNOLOGIES

in terms of disease control and growth promotion. The principle involved in STD is vacuum infiltration by creating a negative pressure followed by absorption of the chemicals inside the setts. This novel mechanized sett treatment technology has been filed as a patent (Malathi et al. 3323/CHE/ 2011- The patent office Journal 21/06/ 2013) as 'Rapid treatment for planting materials of sugarcane and other vegetatively propagated crops'. Subsequently, new units of different sizes were developed in collaboration with ICAR-CIAE-RS,



Coimbatore and validated for the management of fungal diseases with fungicides/ microbes and agro inputs for raising healthy nursery. For management of red rot, smut and wilt, along with sett treatment, other delivery methods viz., soil application, spray and delivery of fungicides through micro-irrigation systems were evaluated.



Larger unit of Sett treatment

Mechanized means of sett treatment

Two/ three budded sugarcane setts were treated with fungicides using the sett treatment device (STD) for field experiments on disease management, while for healthy nursery programme, delivery of different kinds of inputs viz., agrochemicals and microbes (fungicides, insecticides, inducers, micro and macro nutrients, growth hormones, chemicals for abiotic stress tolerance, biocontrol agents, growth promoting bacteria / biofertilizers) were treated in different concentrations and combinations. This method was performed at prescribed vacuum level and duration (15-20 min) in the newly fabricated units.

Disease management

Detailed field trials to manage red rot in susceptible cvCoV 09356 in disease endemic region in Cauvery delta in Tamil Nadu during 2014-15 and 2015-16, indicated that this treatment was able to protect the setts from sett

100 % smut-affected seed cane, delivery of the fungicide propiconazole (100 ppm) through sett treatment device caused drastic reduction in whip emergence and a healthy crop stand, and improved cane yield by 52%.

Mechanized sett treatment for healthy nursery programme

Apart from delivering fungicides and biocontrol agents through the mechanized sett treatment device, studies showed that the mechanized treatment with a mixture of 0.5% super lime, 0.5% urea and 0.1% carbendazim was highly effective in producing vigorous quality settlings as compared to 2.5% concentration of super lime and urea in the conventional sett dipping practices. Overall, in the new method, the dose of the chemicals was reduced by 1/10th from conventional dipping and it was further reduced for combined application. Production of high quality settlings was significantly high at the

Disease management

Detailed field trials to manage red rot in susceptible cvCoV 09356 in disease endemic region in Cauvery delta in Tamil Nadu during 2014-15 and 2015-16, indicated that this treatment was able to protect the setts from soil-borne inoculum of red rot and significantly improved the plant survival under sick plot conditions. Due to better crop stand and reduced disease incidence, cane yield increased significantly in the treated plots. Similarly, with

urea in the conventional sett dipping practices. Overall, in the new method, the dose of the chemicals was reduced by $1/10^{\text{th}}$ from conventional dipping and it was further reduced for combined application. Production of high quality settlings was significantly high at the recommended doses of fungicide, insecticide and nutrients also at stipulated vacuum level was validated at sugar factory locations. Depending on the unit, the vacuum level varied from 200-350 Hg/ mm, which had to be optimized without affecting the germination.



Effective management of smut disease in sugarcane through mechanized delivery of fungicides in the setts (Left: untreated plot with poor establishment; Right: treated plot showing excellent crop stand)

PROMISING TECHNOLOGIES

Under field conditions the disease problems remain due to breakdown of varieties to the pathogens or continuously growing of susceptible varieties in the region. Hence there is need to reduce the damages caused by the diseases till a varietal replacement is made. To manage the diseases through fungicides, an optimized effective delivery of fungicides in single bud or two budded setts/ bud chips has been developed utilizing mechanized-vacuum infiltration approach and the treatment has resulted in more effective diffusion of the chemicals into sugarcane setts / buds due to reduced pressure created in the treatment chamber. The newly devised sett treatment device is portable and easy to operate. Recycling of the chemicals resulted in huge savings in chemical usage for pre-treatment. Field trials conducted at ICAR-SBI and disease endemic locations showed that effective delivery of fungicides through the new device efficiently protected the crop from red rot, smut and wilt. By effective sett treatment, both soil- and sett- borne inocula of the pathogens were killed or inactivated, thus resulting in a significant reduction in disease development.



Production of vigorous sugarcane settlings in the nurseries after mechanized treatment of single buds with fungicide, insecticide and nutrients

with improved germination, growth promotion and tolerance to abiotic stresses. It is expected that adoption of this new approach will effectively manage sugarcane diseases and help to produce healthy seedlings to sustain sugarcane productivity.

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By treating the planting material with different inputs