Original Research Article

A study on the seed health status of farmers' saved rice seed in relation to storage insect pests in Telangana

ABSTRACT

Telangana is considered as seed bowl of India. About 65% of rice produced will be used either for consumption or seed purpose. Hence, farmers save their produce till next season. But in storage it is infested with many insect pests. Due to lack of awareness about scientific storage techniques they are unable to produce quality seed. Eighty five rice seed samples were collected from seven major rice producing areas of the Telangana. Sixty three percent samples were infested with lesser grain borer;*Rhyzopertha dominica*; Angoumois grain moth; *Sitotroga cereallela*, rice weevil, *Sitophilus oryzae*; rust red fllour beetle, *Tribolium cataneum*; Saw toothed beetle *Oryzaephillus surinamensis*. Among these insect pests, Angoumois grain moth and lesser grain borer were predominant.The maximum seed moisture content(12.57%)was recorded in the samples of Miryalaguda district and minimum seed moisture content (9.39%) in samples of Warangal district. The maximum insect infestation(5.73%)was recorded in samples of district Rangareddy and the minimum(0.23%) sample were infested in Mahaboobnagar district.The maximum germination (95%) was noticed in seed sample of Nizamabad district and the minimum (79.57%) in samples of Warangal district. However, the maximum 1745 and minimum 1400 seed vigour index were observed in Nizamabad and Mahaboobnagar districts, respectively.The overall average performance of seed samples collected different villages of seven districts of Telangana were seed moisture content (10.88 %)seed damaged (2.16 %), seed germination (90.43%) and Seed Vigour Index(1539)

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Key words; Survey, rice seed samples, storage insect pests, seed quality

1.INTRODUCTION

The Telangana is considered as seed bowl of India. In Telangana, paddy was cultivated in 64.54 lakh acres during *Vaanakalam* (*Kharif)* season of 2022-23 and 35.84 lakh acres during *Yasangi* season of 2021-22. The production of *kharif*rice was **104.99 million tonnes** [1].The farmers of Telangana usually store more than 65% of the total rice produced to meet the needs either for the food or seed purposes till the next season.But in storage, as much as 50%–60% cereal grains can be lost due to the storage insect pests. In storage, usually the six storage insects were observed *viz.*, lesser grain borer, *Rhyzopertha dominica;*Angoumois grain moth; *Sitotroga cereallela,* rice weevil *Sitophilus oryzae*; rust redflour beetle, *Tribolium cataneum*; rice moth, *Corcyra cepholonica*; Saw toothed beetle *Oryzaephillus surinamensis.*Among these insect pests, Angoumois grain moth and lesser grain borer (*Rhyzopertha dominica*) were predominant. Angoumois grain moth is a primary storage insect pest which is an internal pest and extremely efficient seed penetrator [2]. Angoumois grain moth, *S. cerealella* also known as the rice moth or paddy moth is one of the most dominant species in the stored paddy [3]. In Telangana it is locally known as "Kokku. The newly hatched larvae bores directly into the seed and both larval and pupal development takes place inside the seed. As the larvae tunnels inside the kernels causing considerable damage to the seed and making it more susceptible to secondary insect pests,thereby making it unfit for consumption and planting [4].Before pupation the larva constructs a delicate cocoon just under the seed coat, forming a small circular translucent window. Pupation takes placeinsidethe cocoon. Adults fly emerges,but they are short-lived and generally survive only for 5-12 days. In stores breeding may be continuous throughout the year resulting in cross-infestation [5].

Another primary insect pest is lesser grain borer, perhaps the most potentially destructive insect that infests stored rice [6], can reduce both the quantity and the quality of rice [7]. Larvae feed inside the kernel until they mature into adults and burrow out, damaging the kernels. This reduces milling yield and the proportion of whole rice kernels [7].

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Use of scientific storage methods can reduce these losses to as low as 1%–2%. This paper provides an information about the status and causes of storage losses and the technological interventions to reduce these losses are discussed.

2.MATERIAL AND METHODS

2.1 Collection of rice seed samples : The eighty five rice seed samples(500g. seed for each sample) were collected from farmers during 2018-19 from predominant rice growing districts of Telangana namely; Rangareddy, Nizamabad, Mahaboobnagar, Medak, Medchal- Malkajgiri, Warangal and Miryalaguda.

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2.2 Assessment of insect pests of rice grain under storage condition

The survey was conducted from June to October, samples of 6-18 months storage duration were collected in which seed damage level was most likely to be prevalent. Seed samples were drawn from top, middle and bottom positions of the container with a sampler, from the storage structures. A total of fourteen seed stores were sampled and composite samples were collected from these stores for further assessment in a laboratory. From each container, three samples, each consisting of 500 g of rice seed was taken. Samples were bulked and 500 g sample prepared as sample. Each sample was put in a paper bag and labeled with the necessary information (name of the site, sample number, date of sampling, storage time).The samples obtained from the same storage were mixed together and placed in a cloth bag for further inspection. Besides, information on management practices of the storage insect pests, storage structures, storage conditions were also collected.

2.3 Data collected

2.3.1 Seed damage (per cent)

The seed damage was calculated by taking a random sample of 400 seeds and counting the number of seeds with bored holes by storage insects and converted to percentage.

$$\text{Percentage seed damage} = \frac{\text{Number of damaged seeds}}{\text{Total number of seeds}} \times 100$$

2.3.2 Adult emergence(Number)

The number of live or dead adult insects emerged per 500 g seeds were counted

2.3.3 Seed germination percentage

A total of 400 seeds were randomly selected from each treatment and grouped into three replications of 100 seeds each. The germination test was conducted in the laboratory using between paper methods as per ISTA [8]. One hundred seeds of three replications were placed equidistantly on moist germination paper. The rolled towels were incubated in germination chamber maintained at 25^0C and 90 per cent relative humidity (RH). The first count and final count of germinated seedlings were taken on 7^{th} and 14^{th} day respectively and the percentage of germination was expressed based on the normal seedlings.

$$\text{Germination (\%)} = \frac{\text{No of seeds germinated}}{\text{Total no.of seeds germinated}} \times 100$$

2.3.4 Mean root length and shoot length (cm)

Ten normal seedlings were selected at random from each treatment. The root length was measured from point of attachment of seed to tip of the longest root and shoot length was measured from the point of attachment of seed to the growing meristematic tip and expressed in centimeters (cm).

2.3.5 Seedling vigour index (SVI-I)

The seedling vigour index was calculated as per the formula given by [9].

SVI-I = Germination (%) × mean seedling length (cm).

2.3.6 Seed moisture content at different periods

Moisture content of the seed was estimated byusing Dickyjohn moisture meter

The data on above parameters will be statistically analyzed as suggested by [10].

In addition, the type of storage structure, rice varieties stored, storage duration and type of insect pests infested in different types of storage structure and pest management methods applied were recorded.

1. RESULTS AND DISCUSSION

Out of eight five farmers' saved rice seed samples were collected from different village of six districts in Telangana during 2018-19.

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Among them 64.52 percent sample were found infested storage insect pests while, 91.81 per cent samples were found infested

In Rangareddy district, all twenty seven farmers' saved rice samples were collected from four villages. The average seed damage was **1.79** % and about 40.74% samples were infested by storage insects and about 44.44% samples were having damage beyond permissible limit (>0.5%). The average moisture content was recorded 12.15%. About 89.40% of the samples recorded average seed germination and 96.29 % samples having seed germination above IMSCS. The average seed vigour indexes(1483) of samples were recorded.

In Nizamabad district, all eight farmers' saved rice seed samples were collected from four villages.The average seed damage was 0.82 % and about 25.0% samples were infested by storage insects and about 25% samples were having damage beyond permissible limit (>0.5). The average moisture content was recorded 9.42%. About 99.72% of the

samples recorded average seed germination and 100 % samples having seed germination above IMSCS. The average seed vigour indexes(1746) of samples were recorded.

In Mahaboobnagar district, all 11 farmers' saved seed samples were collected from four villages. The average seed damage was 0.23% and about 18.18% samples were infested by storage insects and about 9.09 % samples were having damage beyond permissible limit (>0.5%). The average moisture content was recorded 9.39 %. and 100.00 % samples having seed germination above IMSCS.The average seed vigoure indexes (1400) of samples were recorded

In Medak, Medchal malkajgiri, Warangal and Miryalguda districts, 5,10,7, 17 farmers' saved seed samples were collected. In medak per cent seed damage was below permissible limit and maintained germination percentage above IMSCS (>80%). In Medchal Malkajgiri two samples out of 10 samples in which per cent damage was above permissible limit. And all the samples maintained germination above 80% with average seed moisture 10.65% and average seedling vigour 1542.

In Warangal district, Out of seven seed samples collected 5 samples were found infested and in which 71.42% samples insect infestation was above permissible limit but 85.71% samples maintained germination above IMSCS. Similarly, In Miryalaguda, average insect damage recorded was 4.94% with none of the samples maintained seed damage below permissible limit. However, 76.47% samples maintained germination percentage above IMSCS.

From the findings it is indicated that predominant insect pest were Angoumois grain moth and lesser grain borer and causing major loss in storage. They cause losses in storage directly through consumption and indirectly making it unfit for planting. The overall average performance of seed samples collected different villages of seven districts of Telangana were seed moisture content (10.88 %) seed damaged (2.16 %),seed germination (90.43%) and Seed Vigour Index(1539) (Fig

1,2,3&4)

[11] has reported that, insect internal infestation has affected the physiological quality of seeds because most insect species feed preferentially on the tender and high proteomic embryo where one could observe a gradual decrease in germination with increase in the adult emergence. [12] reported an increase in the moisture content of grains, *Aspergillus flavus* infection and aflatoxin accumulation in contrast to a decrease in germinability as a result of infestation by *S. oryzae* in maize. Similarly, [13] reported that damaged seeds had low per cent germination and reduced weight as evidenced in the present results.The seed damage in different districts ranged from 0-19.86%. Similar results were reported by other scholars 'studied in other parts of the country that seed damage ranged from 20–50% in different traditional grain stores [14].Seed damage is caused due to many factors, among the factors, seed storage duration, storage type and management practice that can influence seed damage by insect pests. Seed quality like germination is in turn affected by method of storage, ambient humidity and temperature, market access and household education [15]; [16]; [17].

These results were also similar to [18]; [19]; [20] and [21].

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Sr. No.	Location	Crop/ variety	Storage period	No of samples collected	No of samples infected	Name of insects present	Per cent seed damage (range)	Per cent seed sample with seed damage beyond permissible limit	Seed Moisture (%) (range)	Mean Seed Germination (%) with range in parenthesis	Per cent seed sample with seed germination within permissible limit	Mean vigour index (with range)

Table 1: Survey and evaluation of seed health status of farmers' saved seed with respect to insect infestation (2018-19)

1	Ranga reddy	Paddy	12 M	23	14	A,R,T	0-6.4	43%	10.5-13.4	82.6-100	100	1177-1853
2	Ranga reddy	Paddy	18 M	4	4	A,R,T	0.23-10.62	50%	11.5-13.2	15-100	93%	352-1782
3	Nizamabad	Paddy	6 M	8	2	A,R	0.00-3.35%	25%	9.2-9.6	98-100	100%	1626-1862
4	Mahbubnagar	Paddy	6 M	10	1	A,R,	0-2.15%	10%	9.1-9.6	83-100	100%	1294-1509
5	Mahbubnagar	Paddy	18 M	1	1	A,R,T	0.43	0%	9.5	88.3	100%	1530
6	Medak	Paddy	18 M	5	5	A,R,T	0.4-0.91%	80%	11.2-11.6	94-96	100%	1423-1521
8	Medchal-Malkajgiri	Paddy	12 M	3	1	A,R,T	0-0.15%	0.00%	10.2-10.5	98-100	100%	1437-1542
9	Medchal-Malkajgiri	Paddy	18 M	7	4	A,R,T, RW, STB	0-5.33%	28.57%	10.00-11.5	97-100	100%	1437-1542
10	Warangal	Paddy	6 M	7	5	R,STB	0-19.86%	71.43%	11.25-12.35	24-100	71%	
11	Miryalaguda	Paddy	6 M	17	17	A,R,T	0.51-16.36	100%		40-100	82%	

A=Angoumois grain moth **RW=Rice weevil**

R=*Rhyzopertha dominica* **STB=Saw toooth beetle**

T=*Tribolium* sp.

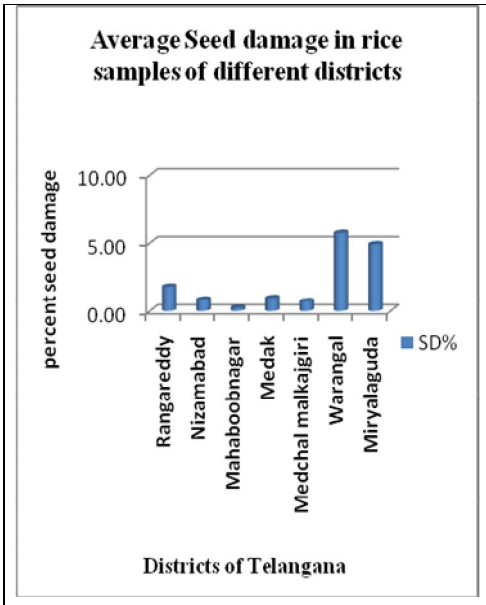

Fig. 1. Average Seed damage in rice samples of different districts

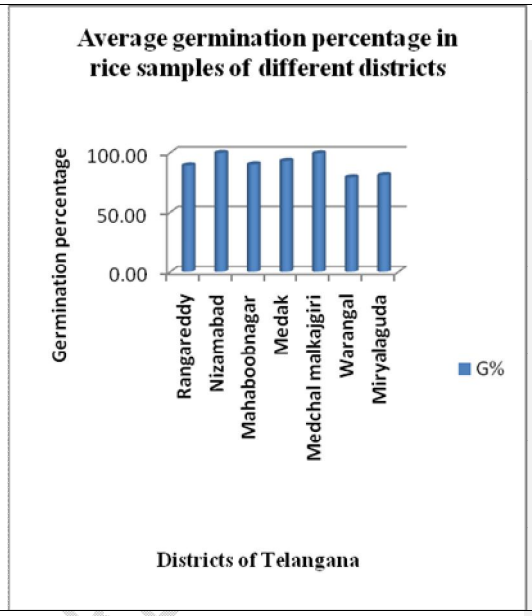

Fig. 2. Average germination percentage in rice samples of different districts

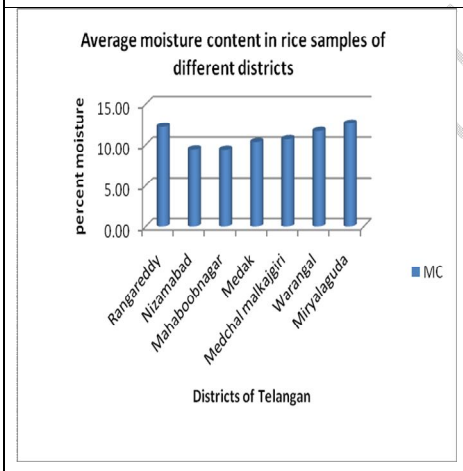

Fig. 3. Average moisture content in rice samples of different districts

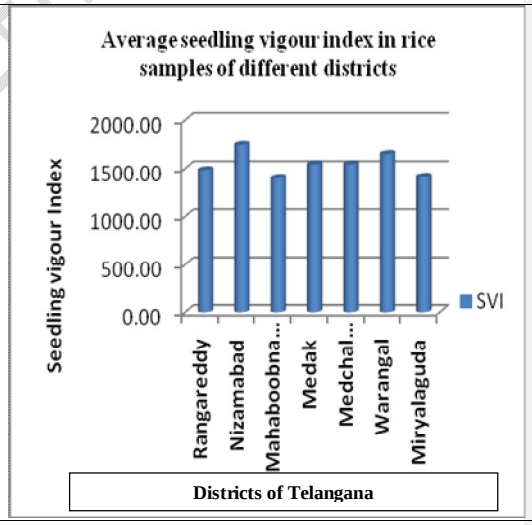

Fig. 4. Average seedling vigour index in rice samples of different districts

CONCLUSION: Diverse variation observed in the *storage insect pests* incidence among the different districts and samples indicate their adoptability to different abiotic factors. The age of seed stock as well as the cultivars from which the samples were drawn also influence the incidence of storage insect pests. The variation in the pest dominance was also due to source of primary field infestation at seed production centers and the source of secondary cross infestation at local distributors godown. The above observations clearly show that the prevalence of insect pests is largely due to the inadequacy of sanitary awareness, which is essential to keep godowns clean and tidy. Accumulation of filth and refuse near the godowns forms a perpetual and recurring harbourage for insect development. Proper disposal of the sweeping is compelling necessity to reduce the insect activity in the godowns. Cross infestation has been found to be an invariable occurrence. Hence, regular prophylactic measures will help to protect grain from the ravages of the pests. Training of farmers regarding production and post-production activities for healthy, pest free quality seed is very essential to meet seed requirements.

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