ALL INDIA COORDINATED SMALL MILLETS IMPROVEMENT PROJECT

ECO-FRIENDLY MANAGEMENT OF BLAST OF FINGER MILLET [*Eleusine coracana* (L.) Gaertn] THROUGH ON FARM ADAPTIVE RESEARCH

S. S. Madhukeshwara[1], S. G. Mantur[1], A. Ramanathan[2], J. Kumar[3], T. B. Anilkumar[1] and M. Kimata[4]

[1]AICRP on Small Millets, University of Agricultural Sciences,Gandhi Krishi Vignana Kendra, Bangalore-560065, India; [2]Dept. of Millets, Tamilnadu Agricultural University, Coimbatore-641003, India; [3]Dept. of Plant pathology, G. B. Pant University of Agriculture and Technology, Hill Campus, Ranichauri, Dist..Tehri,Uttaranchal, 249199 , India; [4]Field Studies Institute for Environmental Education, Tokyo Gakugei University, Japan

ABSTRACT

The On Farm Adaptive Research (OFAR) trials for integrated management of blast of finger millet through cheap methods by use of host resistance and seed treatment were taken up during *Kharif* 2001-2002 and 2002-03 in each farmers field in an area of 4,000 mt^2 with four treatments. Each treatment was in 1000 mt^2 area. The treatments were T_1: Farmers variety + Untreated, T_2: Farmers variety + Seed treatment with carbendazim @ $2g^{kg}$ seed, T_3 : Resistant variety (GPU 28/VL 149/Co 13) + Untreated, T_4 : Resistant variety (GPU 28/VL 149/Co 13) + Seed treatment with carbendazim @ $2g^{kg}$ seed, along with recommend FYM and fertilizer dose each treatment was in 1000 mt^2 area.

The trials were taken up in more than 40 locations in each year in 12 districts of finger millet growing regions of Karnataka, Tamilnadu and Uttaranchal. The yield recorded was higher than the normal yield in the treatment Resistant variety + Seed treatment of Carbendazim @ $2g^{kg}$. There was an 50-100% yield increase compared to control. The results indicated significant difference over farmers practice. Farmers expressed their willingness to adopt the technology in their regular practice. The OFAR plots also served as demonstration of technological capability in the enhancement of finger millet productivity. This eco-friendly, environmentally safe, financially viable, low cost, effective technology was readily adopted in their cultivation practices and quite natural that it was also socially acceptable by farmers.

Key Words: On Farm Adaptive Research, Finger millet blast, Seed treatment, resistance

Introduction

Of the several diseases that afflict finger millet, blast (*Pyricularia grisea*) is not only widely distributed in almost all the finger millet growing regions of the world, but also is the most destructive disease. The disease is known to occur in India (Mc Rae, 1920) Srilanka, (Park 1932) Nepal, (Thompson, 1941) Malaya, (Burnett 1949) Tanzania, (Kuwite and Shao 1992) Somalia (Mohamed, 1980), Tanganika (Wallaee and Wallace, 1948; Wallace 1950) Zambia (Muyanga and Danial, 1995), Ethiopia, Kenya, Uganda (Dunbar, 1969, Anon., 1959, Adipala, 1992) etc., In India the disease is prevalent wherever finger millet is grown viz., Karnataka, TamilNadu, Maharastra, Andhra Pradesh, Orissa, Bihar, Uttaranchal etc., The disease was reported for the first time in India, from Tanjore delta of TamilNadu by Mc Rae (1920). It was subsequently reported from the princely state of Mysore (Venkatarayan, 1937), Uttara Pradesh (Mehtha and Chakravarthy, 1937), Bihar (Thirumalachar and Mishra, 1953), Assam (Roy, 1989) etc. Venkatakrishnaiya (1935) and Patel (1955) considered the disease of ragi as relatively unimportant, Mishra (1959), Ramakrishnan (1963) have reviewed the disease situation in India. Ragi blast in Himalayan region appears at lower elevation (< 1600 m) and causes 25-40% loss (Bisht *et al.,* 1997). Yield reduction upto 100 per cent was recorded at Rampur, Nepal (Batsa and Tamang, 1983). Ramappa, *et al.,* (2002) recorded upto 50 per cent neck blast and 70 per cent fingerblast during *Kharif* 2000 in Mandya and Mysore districts. In India, Blast is one of the major diseases causing recurring yield losses in all the states (Seetharam, 1983). Viswanath and Seetharam (1989) have dealt etiology and management of blast along with other diseases of ragi, Pall *et al.,* (1980) reviewed the work on diseases of lesser millets, which included disease of ragi too and more particularly blast of ragi.

On Farm Adaptive Research (OFAR) help in evaluating the newly developed technologies on the farmers field involving very closely the farmers in that process. This also provides an opportunity to the scientists to evaluate the strength and weakness of the technology from the point of end user and bring in necessary refinements, if need be. It has often been observed that farmers have either not adopted or have partially adopted technologies recommended by Research Stations/centres/institutes. It is also fact that farmers vary in many socio-economic parameters.

Finger millet being a low value crop and generally grown as rainfed crop and most often on marginal or poor soil, does not offer any scope for such additional cash inputs like application of fungicides. The most effective way of avoiding the disease and thereby the loss is by cultivation of varieties resistant to the disease. Hence an attempt was made to control the menace by integrating seed treatment and host resistance in OFAR programme.

The technology, has therefore, was tested by taking into account the realist environment and with farmers participation through 'On Farm Adaptive Research' approach in specific recommendations domain, characterized by relatively homogenous farming system associated with similar agro-climatic conditions. These trials were conducted in Karnataka, Tamil Nadu and Uttaranchal states of India (Table 1 & 2).

Table1 : Districts Covered Under On Farm Adaptive ResearchTrials

Sl. No.	Districts
Karnataka	
1	Bangalore
2	Chamarajnagar
3	Chitradurga
4	Hassan
5	Haveri
6	Kolar
7	Mysore
8.	Haveri
9	Tumkur
Tamilnadu	
1.	Dharmapuri
2.	Coimbatore
Uttaranchal	
1.	Tehri

Table 2 : Summary of on farm trials conducted
For the Year : 2000-03

State	On station trials	On farm trials	Area covered (Ha)	# of farmers covered	# of villages covered	# of district covered
Karnataka	6	69	27.6	69	30	8
Tamil Nadu	4	23	9.2	23	15	2
Uttaranchal	3	23	0.5	23	11	1
Total	13	115	37.3	115	56	11

Materials and Methods

Experiments were conducted in the farmers field during *Kharif* 2001-02 and 2002-03 in an area of 4000 mt^2. There were four treatment which included T_1: Farmers variety + Untreated, T_2: Farmers variety + Seed treatment with carbendazim @ $2g^{-kg}$ seed, T_3 : Resistant variety (GPU 28/VL 149/CO 13) + Untreated, T_4 : Resistant variety (GPU 28/VL 149/CO 13) + Seed treatment with carbendazim @ $2g^{-kg}$ seed, along with recommend FYM and fertilizer dose. Each treatment occupied in an area of 1000 mt2. The trials were taken in collaboration with State

Department of Agriculture, Extension Education Units (EEU) and Operational Research Projects (ORP) in Water Shed Areas of the State Agricultural Universities (SAU). Due care was given in the selection of experimental area such as water shed, fertility level, socio-economic status, for choosing representative area of the entire tract. The farmers so chosen that represented the different socio economic groups. The experimental plots were periodically monitored and reviewed by the Peer Review Team (PRT) and Site Committee of the respective universities in Karnataka, TamilNadu and Uttaranchal. The Biometrical observations and other information required were recorded.

The situations existing to prior to OFAR interventions were as follows:

1) Sowing at convenience
2) Not aware of varietal reactions to blast
3) Indiscriminate use of fertilizers
4) Lack of cultural management
5) 20-25% recurring yield loss
6) Finger millet is staple food for poor people and
7) Blast cause serious yield loss and grown under rainfed situation

The proposed Integrated Blast Management of Finger millet aimed at educating and demonstrating the farmers about the importance of improved practices such as –

1) Optimum time of sowing (Before July)
2) Creating awareness on the availability of resistant variety (GPU28 &VL149)
3) Use of green manure (Cowpea)
4) Use of balanced nutrition (50:40:25 NPK/ha^{-1})
5) Use of Farm Yard Manure (7.5t/ha^{-1})
6) Optimum spacing (30cmX10cm) and maintaining ideal population
7) Early warning and Prediction of blast based on epidemiological factors
8) Demonstrating the advantages of integrated blast management

Farmers were provided with all the inputs required such as Seed, Fertilizers and Fungicide apart from enlightened them about integrated blast management technology (See Schematic Diagram). Opinions of the farmers were recorded after the trial.

Results and discussion

The results of the OFAR trials helped in convincing the farmers of the importance of resistant variety in place of local variety/improved susceptible variety. The advantages of simple and low cost technology like seed treatment with carbendazim @ 2g/kg seed in preventing blast disease in the initial stages at nursery were also appreciated by the farmers. The seed treatment was given to protect the young seedlings from the leaf blast since all the finger millet cultivars

available are susceptible for leaf blast including resistant varieties. There are only two released varieties, which are resistant for blast. The resistant varieties prevailing are resistant only against Ear and Finger blast but susceptible to leaf blast. The seed treatment technique to control leaf blast came handy and safe method without much application of fungicides to protect young seedlings in the nursery stage.

The resistant variety GPU 28 was found ready acceptance by the farmers in both the states of TamilNadu and Karnataka because of its high level of resistance against ear and finger blast as well as yield potential. On the other hand in Uttaranchal variety VL 149 was the most suitable variety. The important message went in the minds of farmers was that the change of variety would create wonders in boosting yield. Majority of the finger millet growing farmers are poor small and marginal farmers, who cannot afford to take up chemical control and buy costly inputs for management. Thus integrated management technology where blast resistant cultivar was the major component came handy to the farmers (Table 3, 4 & 5).

Table 3 : CONSOLIDATED RESULTS OF ON FARM ADAPTIVE RESEARCH TRIALS IN KARNATAKA AND TAMILNADU (2000-2003)

(Farmers variety Indaf/ HR911/Local)

Treatments	2000-2003			
	LB (G)	NB (%)	FB (%)	Yield (kg/ha)
T_1 : Farmers variety + Untreated	4.0	6.1	6.8	1676
T_2 : Farmers variety + Seed treatment with Carbendazim @ $2g^{-kg}$ seed	0.2	3.1	3.9	1827
T_3 : GPU 28 + Untreated	4.0	0.4	1.3	2524
T_4 : GPU 28 + Seed treatment with Carbendazim @ $2g^{-kg}$ seed	0.2	0.1	0.6	2708

The OFAR trials also served the purpose of validation of technology developed and hands on experience to the farmers in the adoption of technology at field level. The trial plots not only served as research plots but also demonstration plots of technological capability in breaking traditional notions blind beliefs and convictions of poor farmers which helped in yield enhancement. The interaction sessions held with scientists during field day and training programme further cleared the doubts in their mind in technology adoption.

The wide dissemination of integrated blast management technology in the finger millet areas was very important as susceptible varieties were predominantly grown largely in Finger millet growing states. The OFAR mode trials were a success story as how a technology is capable of bringing change in agriculture production. The training programme sessions conducted were

Table 4 : CONSOLIDATED RESULTS OF ON FARM ADAPTIVE RESEARCH TRIALS IN TAMILNADU (2001- 02)

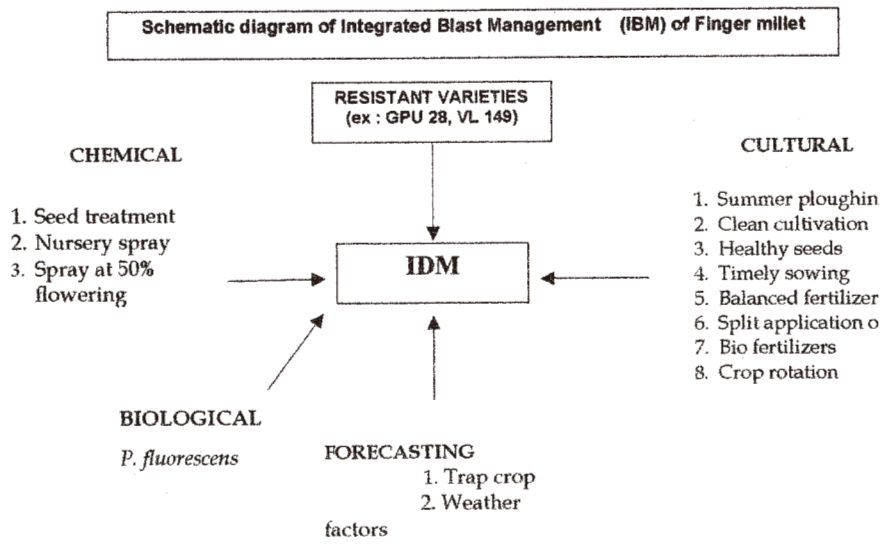
(Farmers variety Local)

Treatments	2001-2002			
	LB (G)	NB (%)	FB (%)	Yield (kg/ha)
T_1 : Farmers variety + Untreated	2.33	7.40	7.91	1399
T_2 : Farmers variety + Seed treatment with Tricyclazole @ $2g^{-kg}$ seed	4.00	8.37	9.05	1447
T_3 : CO 13 + Untreated	2.33	5.31	8.28	2985
T_4 : CO 13 + Seed treatment with Tricyclazole @ $2g^{-kg}$ seed	1.66	4.00	4.67	3137

Table 5 : CONSOLIDATED RESULTS OF ON FARM ADAPTIVE RESEARCH TRIALS IN UTTARANCHAL STATE (2000-2003)

(Farmers variety Local)

Treatments	2000-2003		
	NB (%)	FB (%)	Yield (kg/ha)
T_1 : Farmers variety + Untreated	29.88	31.72	2050
T_2 : Farmers variety + Seed treatment with Carbendazim @ $2g^{-kg}$ seed	29.36	30.6	2196
T_3 : VL149 + Untreated	0	1.27	2667
T_4 : VL149 + Seed treatment with Carbendazim @ $2g^{-kg}$ seed	0	1.12	2761



were also quite helpful in bringing attitudinal change of the farmers and obtain feedback for further refinement of the technology to suit the felt needs of the locality of the farmers.

Acknowledgements: Authors are thankful to National Agricultural Technology Project (NATP RNPS-4), Indian Council of Agricultural Research, and New Delhi for sponsoring the ad-hoc project. Authors are grateful to Dr. A. Seetharam, Emeritus professor and Former Project Coordinator (Small Millets) for his constant interest, encouragement and guidance during the course of study.

References:

Adipala, E., 1992, Diseases of finger millet in Uganda. In : *Sorghum and Millets Diseases : A second world review* (Eds) de Milliane, W.A.J., Frederiksen, R.A. and Bengston, G.D., ICRISAT, Patancheru, India. pp 370.

Anonymous, 1959, Annual report of the Department of Agriculture, Uganda for the year ended 31st Dec 1958 75 pp.

Batsa, B.K. and Tamang, D.B., 1983, Preliminary report on the study of millet diseases in Nepal. In : *Maize and Fingermillet, 10th Summer*

Bisht, G.S., Harish Singh, Singh, H., Sati, S.C., 1997, Fungal disease of useful plants in th Garhwal Himalaya and their management. In : *Himalayan microbial diversity Part I*, (Eds) Saxena, J and Dubey , R.C. pp 255-271.

Burnett, F. 1949, *Report on agriculture in Malaya for the year* 1947 86 pp.

Dunbar, A.R., 1969, *The annual crop loss of Uganda*, East African Literature Bureau, Dasp es salam, Nairobi, Kampala.

Kuwite, C.A. and Shao, F.M., 1992, *Pyricularia* spp causing head blight of fingermillet (*Eleusine coracana),* and other fungi associated with finger millet in Tanzania. In : *Sorghum and millets diseases; a second world review*. Eds. Millians, W.A.J. de; Frederiksen, R.A. and Bengston, G.D. ICRISAT, Patancheru, A.P, India.

Mehta P.R. and Chakravarthy, S.C., 1937, A new disease of *Eleusine coracana* Gaertn. *Indian J. Agric. Sci..*, **5** ; 793-96.

Mishra, A.P., 1959, Disease of Millets and Maize – A review of work done in India during 1931-58. *Indian Agric.* **3** : 75-89.

Mohamed, M.I., 1980, A disease of *Eleusine coracana* new to Somalia. *Riv. Agric. Sutro. Trop.*, **74** : 73-79.

Muyanga, S., and Danial, D.L., 1995, Production and research review of Small Millets cereals in Zambia. In : *Breeding for disease resistance with emphasis on durability* Ed. Danier, D.L. Wayeningen Agril. Univ. Wayeningen, Netherlands, p. 60-64.

Pall, B.S., Jain, A.C. and Singh, S.P., 1980, *Diseases of Lesser Millets*. Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, India pp. 69.

Park, M., 1932, *Report of the workdone of the mycological division.* Adm. Rep. Dir. Agric., Ceylon 103-11.

Patel, M.K., 1955, A short note on diseases of millets. *Poona Agri. College. Magi.*, **46** : 188.

Ramakrishnan, T.S., 1963, *Diseases of Millets* ICAR, New Delhi, pp 152.

Ramappa, H.K., Ravishankar, C.R. and Prakash, P., 2002, Estimation of yield loss and management of blast disease in fingermillet (ragi). *Proc. Asian Cong. Mycol. Pl. Path.* Oct 1-4, 2002, Univ. of Mysore, Mysore P. 195.

Roy, A.K., 1989, Further records of plant disease from Karbi Anglong dist. Assam, *J. Res.* **10** : 88-91.

Thompson, A., 1941, Notes on Plant diseases in 1940. *Malay agric. J.*, **24** : 241-45.

Seetharam, A., 1983, Identification of sources of resistance to ragi blast and its utilization in breeding. In: *Nat. Semi. Br. Cr. Plants for resistance to pests and diseases* 25-27 May, 1983. TNAU, Coimbatore

Thirumalachar, M.J. and Mishra, J.N., 1953, Some disease of economic plants in Bihar, India. *FAO Plant Prot. Bull.*, **1** : 145-146.

Thompson, A., 1941, Notes on Plant diseases in 1940. *Malay agric. J.*, **24** : 241-45.

Venkata Krishanaiah, N.S., 1935, Leaf blight and foot rot of ragi (*Eleusine coracana*). *J. Mysore Agri. Exp. Union.*, **15** : 125-29.

Venkatarayan, S.V., 1937, *Report of the work done in the mycological section during the year 1935-36.* Admn. Rep. Agric. Dept. Mysore, 1935-36, 51-55.

Viswanath, S. and Seetharam, A., 1989, Disease of Small Millets and their management in India. In : *Small Millets in Global Agriculture* (Eds) Seetharam, A., Riley, K.W. and Harinarayana, G. Oxford IBH puplication Co. Pvt. Ltd. Pages 237-253.

Wallace, 1950, Plant pathology, *Rep. Dep. Agric. Tanganyika* 1948, pp 45.

Wallace and Wallace, 1948, Tanganyika territory fungus list. Recent research. *XI Mycol. Cir. Dep. Agric. Tanganyika* 24 pp. 5.