Compiled Report (1994 to 1999)

I. EXPERIMENTS

1. Response of pre-released finger millet varieties to the levels of nitrogenous fertilizer.

Pre-released varieties of finger millet needs evaluation to nitrogen levels for yield under rainfed conditions across different agro-climatic conditions.

The investigations undertaken during 1994 *kharif* revealed that finger millet varieties viz. EC 5-90, VL 146, PPR 2614 and HR 911 were tested for their response to levels of nitrogen (0, 20, 40, 60 and 80 kg/ha) with common dose of P and K fertilizers. Among the varieties, check varieties HR 911 gave the highest yield (4289 kg/ha) compared to pre-released varieties (3224 to 3971 kg/ha). Similar trend was noticed in respect of straw yield also.

Increase in grain yield with increase in levels of nitrogen was observed (3015 to 4321 kg/ha). Grain yield difference was more prominent at lower (0 and 20) and higher levels (80 kg/ha) of nitrogen than between 40 and 60 kg N/ha. The cost benefit ratio revealed that higher returns were obtained at lower nitrogen levels (20 and 40 kg N/ha) and beyond this the benefit cost ratio decreased considerably.

During 1995, finger millet varieties viz., VR 708, KM 225, PES 400 and check variety HR 374 were tested for their response to the levels of nitrogen (0,20,40 and 60 Kg/ha) with common dose of P & K fertilizer. Among the varieties, KM 225 gave higher yield (4573 Kg/ha) and was on par with the check variety HR 374 (4547 Kg/ha). VR 708 and PES 400 were low yielders (3891 and 3866 Kg/ha). Increase in grain yield with the increase in level of nitrogen was observed (3682 to 4746 Kg/ha).

Further in 1996, finger millet varieties viz., PES 400, GPU 34, VR 530 and PR 202 were tested for their response to levels of nitrogen (0,20,40 and 60 kg/ha) with a common dose of P and K fertilizers. The varieties tried were on par in their performance. Increase in grain yield with increase in level of N was observed. However, there was no significant difference in yield at 40 kg N/ha (2690 kg/ha) and 60 kg N/ha (3006 kg/ha).

Whereas in 1997, finger millet pre-release varieties viz., VR 687, KM 232, HK 50-16 and PR 202 (check) variety were tested for their response to levels of nitrogen (0,20,40 and 60 kg/ha) with common dose of P_2O_5 and K_2O fertilizers. The check variety PR 202 (3572 kg/ha) gave the highest yield and among the pre-release varieties VR 687 gave higher yield (3343 kg/ha) followed by HK 50-16 (2721 kg/ha). Increase in grain yield with increase in level of nitrogen was observed (1963 to 3914 kg/ha). However, varieties and nitrogen interaction was not significant.

During 1998, pre-released varieties of finger millet belonging to three different duration groups viz., long, medium and short duration types were tested separately for their response to different levels of nitrogen (20,40,60 and 80 kg/ha) with a common dose of P_2O_5 (40 kg/ha) and K_20 (25 kg/ha). In all the three trials increase in yield with the successive increase in the level of nitrogen was observed. Grain yield was significantly lower at lower N levels as compared to highest level while it was intermediate at moderate

levels in all trials. Interactions effects due to the levels of nitrogen and varieties were non-significant**.**

Among the short duration varieties pre-release variety PPR 2709 (4481 Kg/ha) out yielded other pre-released varieties including the check variety Indaf 9 (4008 kg/ha) and PES 400 (3591 Kg/ha). Among medium duration varieties, significant differences in grain yield were not observed. However, pre-release variety GPU 38 (4428 kg/ha) gave comparable yields to that of check variety Indaf 5 (4426 kg/ha). Among long duration varieties group BM 107-2 (3812 kg/ha) was found promising and was significantly superior to check variety Indaf 8 (3410 kg/ha).

Similarly in 1999, pre-released varieties of finger millet belonging to three different duration groups viz. long, medium and short duration types were tested separately for their response to different levels of nitrogen (20, 40, 60 and 80 kg/ha) with a common dose of P_2O_5 (40 kg/ha) and K_2O (25 kg/ha). In all the three trials, although there was increase in grain yield with the increase in the levels of nitrogen was observed whereas, the differences in the grain yield were significant for long and medium duration but non significant difference in yield was noticed by short duration varieties for nitrogen levels. Interaction effects due to the levels of nitrogen and varieties were also non-significant.

Among long duration varieties OEB 10 (2443 kg/ha) performed better than check variety Indaf 8 (2087 kg/ha) whereas under medium duration none of the pre-release varieties out yielded check variety (1957 to 2157 kg/ha). Similar trend was noticed among short duration varieties also (1778 to 2034 kg/ha). In an another trial where, all the three duration groups of varieties were included and studied for their yield performance at different levels of nitrogen. It was found that long duration variety L5 gave highest yield (5028 kg/ha) followed by GPU 28 (4581 kg/ha) and GPU 26 (4488 kg/ha). It was interesting to note that the performance of Indaf 8, Indaf 5 and Indaf 9 were lower.

Pre-released varieties have shown differential response to nitrogen levels. Among the nitrogen levels, 60 kg N/ha has been found to be ideal for maximizing production.

Table 1.1. Grain and straw yield of finger millet varieties as influenced by nitrogen doses under rainfed conditions (1994-95)

Treatments	Yield (Kg/ha)	
	Grain	Straw
Varieties		
EC 50-90	3525	3765
VL 146	3224	2782
PPR 2614	3971	4620
HR 911	4289	4819
SEm ±	92	104
CD @ 5%	263	297
Nitrogen (kg/ha)		
0	3015	2971
20	3630	3730
40	3864	4157
60	3933	4322
80	4321	4802
SEm ±	103	116
CD @ 5%	294	332
N x V interaction		
SEm ±	205	232
CD @ 5%	NS	665

Table 1.2. Yield and Economics of nitrogen fertilization in finger millet under rainfed conditions

N (kg/ha)	Yield /kg N		B:C ratio
	Grain	Straw	
0	-	-	-
20	33.7	37.9	21.2
40	11.7	21.3	7.8
60	3.4	8.25	2.6
80	19.4	24.0	12.4

Table 1.3. Grain and straw yield of finger millet varieties as influenced by nitrogen doses under rainfed conditions (1995-96)

Treatments	Yield (Kg/ha)	
	Grain	Straw
Varieties		
VR 708	3891	3447
KM 225	4573	5298
PES 400	3866	4145
HR 374 (Check)	4547	5228
SEm ±	96	95
CD @ 5%	196	194
Nitrogen (kg/ha)		
0	3682	3467
20	4108	4508
40	4342	4936
60	4746	5206
SEm ±	96	95
CD @ 5%	196	194
N x V interaction		
SEm ±	167	189
CD @ 5%	NS	386

Table 1.4. Grain and straw yield of finger millet varieties as influenced by nitrogen doses under rainfed conditions (1996-97)

Treatments	Yield (Kg/ha)	
	Grain	Straw
Varieties		
GPU 34	2233	1996
PES 400	2527	2135
VR 530	2468	2515
PR 202(check)	2129	2136
SEm ±	153	353
CD @ 5%	NS	NS
Nitrogen (kg/ha)		
0	1347	1198
20	2313	1836
40	2690	2794
60	3006	2953
SEm ±	153	353
CD @ 5%	442	1019
Nitrogen x Varieties		
SEm ±	305	706
CD @ 5%	NS	NS

Table 1.5. Grain and straw yield of finger millet varieties as influenced by nitrogen doses under rainfed conditions (1997-98)

Treatments	Yield (Kg/ha)	
	Grain	Straw
Varieties		
VR 687	3343	4745
KM 232	2231	4638
HK 50-16	2721	4118
PR 202(check)	3572	5274
SEm ±	158	207
CD @ 5%	456	599
Nitrogen (kg/ha)		
0	1963	2959
20	2756	4101
40	3242	5184
60	3914	6531
SEm ±	158	207
CD @ 5%	456	594
Nitrogen x Varieties		
SEm ±	316	415
CD @ 5%	NS	NS

Table 1.6. Grain and straw yield of finger millet varieties as influenced by nitrogen doses under rainfed conditions (1998-99)

Treatments			Yield (kg/ha)					
Varieties (V)			LD		MD		SD	
Long duration	Medium duration	Short duration	Grain	Straw	Grain	Straw	Grain	Straw
SRS 2	BM 9-1	PPR 2708	3443	5433	4068	8838	3546	6706
BM 107-2	GPU 38	PPR 2709	3812	6636	4428	7660	4481	6607
GPU 39	BM 11-1	KM 240	3426	7071	4148	8039	3173	6678
PR 202	TNAU 889	PES 400	3353	6678	3939	8796	3591	6565
Indaf 8	HR 374	Indaf 9	3410	6469	3939	6565	4008	5611
	Indaf 5				4426	8880		
		SEm ±	76	192	204	370	140	318
		CD @ 5%	222	NS	NS	1066	287	NS
Nitrogen (Kg/ha) (N)								
20			3078	6145	3847	7492	3239	5850
40			3463	6111	4224	7996	3862	6498
60			3925	7116	4402	8901	4369	6952
		SEm ±	59	382	144	262	109	246
		CD @ 5%	171	NS	414	754	316	712
NxV interactions								
		SEm ±	132	854	353	642	242	551
		CD @ 5%	NS	NS	NS	NS	NS	NS

Table 1.7. Yield (kg/ha) of long duration pre-released finger millet varieties as influenced by nitrogen levels under rainfed conditions. (1999-2000)

Treatments			Yield (kg/ha)					
Varieties (V)			LD		MD		SD	
LD	MD	SD	Grain	Straw	Grain	Straw	Grain	Straw
MR 21	ZAH 1	TANU 918	2133	3201	2016	2998	1967	2751
OEB 10	DPI 21-34	KM 251	2443	2681	1957	3051	1820	2703
GPU 47	PPR 2681	KM 252	2428	2526	2157	2742	1778	2729
PR 202	HR 374	PES 400	2284	3218	2031	2434	1941	2526
Indaf 8	GPU 28	Indaf 9	2087	2822	2080	3033	2034	2901
		SEm ±	77	97	110	114	93	116
		CD @ 5%	223	281	NS	330	NS	NS
Nitrogen (Kg/ha) (N)								
40	20	20	2193	2709	1881	2682	1795	2465
60	40	40	2257	2801	2052	2878	1896	2897
80	60	60	2375	3159	2211	2995	2043	2828
		SEm ±	59	75	86	88	72	90
		CD @ 5%	NS	218	249	NS	NS	260

NxV interactions						
SEm ±	-	168	119	197	161	201
CD @ 5%	-	NS	NS	NS	NS	NS

2. Identification of pigeon pea varieties for intercropping in finger millet for simultaneous sowing

During 1994, a feeler trial involving fifteen pigeon pea varieties were sown simultaneously in finger millet in 2:8 row proportion to find out suitable pigeon pea variety for intercropping in finger millet. Recommended practices for finger millet were adopted. Among the pigeonpea varieties tested, ES 90, ICPL 88046, KBPH 1 and TTB 7 were found suitable.

During 1995, ten pigeon pea varieties were sown simultaneously in finger millet, in 8:2 row proportions to find out suitable pigeon pea variety for intercropping in finger millet. Recommended practices were adopted in raising these crops. A dead furrow was opened in between paired rows of pigeon pea to conserve rainwater. Forming a dead furrow at every 3.3m interval in finger millet gave significantly higher gross returns (Rs. 24,791/ha) than without this conservation measure (Rs. 20,063/ha). Among pigeon pea varieties, Hybrid 4 (422 kg/ha), KM 10 (385 kg/ha), CORG 11 (303 kg/ha), TTB 7 (351 kg/ha) and ICPL 88047 (295 kg/ha) were high yielders than other varieties. Adjacent crop rows of finger millet were least affected by pigeon pea varieties particularly ICPL 88047, KM 10 and Hybrid 4. Growing pigeon pea in combination was found to bring higher returns (Rs.24, 577.00 to Rs.27, 237.00/ha) than monocropping of finger millet (Rs.20, 063.00/ha).

Table 2.1. Yield and monetary returns as influenced by intercropping Ragi + Redgram varieties (8:2) under rainfed condition (1995-96)

Treatments	Yield (kg/ha)				Monetary returns (Rs/ha)
	Ragi		Redgram		
	Grain	Straw	Grain	Straw	
Ragi entire (Indaf 8)	3373	5051	-	-	20,063
Ragi with dead furrows	4323	5315	-	-	24,791
Ragi + Pigeon pea var. ES 90 (8:2)	3450	4642	272	785	24,577
Ragi + Pigeon pea var. TTB 7 (8:2)	3251	4016	351	1042	24,424
Ragi + Pigeon pea var. Hybrid 1 (8:2)	3825	4497	277	617	26,090
Ragi + Pigeon pea var.Hybrid 4 (8:2)	3379	4016	422	1283	26,207
Ragi + Pigeon pea var.ICPL 88046 (8:2)	3824	4233	200	818	24,879
Ragi + Pigeon pea var. AK 88-11 (8:2)	3700	4642	246	585	25,316
Ragi + Pigeon pea var. CORG 11 (8:2)	3902	4305	303	818	26,949
Ragi + Pigeon pea var. ICPL 88047 (8:2)	3872	4425	295	633	26,745
Ragi + Pigeon pea var. RA 4(8:2)	3861	4401	94	545	23,440
Ragi + Pigeon pea var. KM 10(8:2)	3685	4257	385	1090	27,237
SEm±					940
CD @ 5%					2,756

Produce :	Ragi grain	Ragi straw	Pigeon pea grain	Pigeon pea stalk
Selling rate: (Rs/kg)	4.75	0.80	16	0.15

Table 2.2. Yield and monetary returns as influenced by intercropping different pigeon pea genotypes in finger millet under rainfed conditions. (1997-98)

Further, in 1997 *kharif*, different pigeon pea varieties (TTB 7, Japan Super, AKT 9221 and ICPL 87 respectively) were tested as intercrops in finger millet varieties (Indaf 8 and VR 708).

The results revealed that intercropping of finger millet variety Indaf-8 and pigeon pea (8:2) varieties TTB 7 and AKT 9221 gave higher and comparable monetary returns (Rs.14, 662/- and 14,346/ha) and both were superior to sole crop of finger millet (Rs.10, 982 and 8,475/ha). Intercropping ragi with long duration variety Indaf 8 with pigeon pea genotypes (8:2) was found beneficial in enhancing productivity and monetary returns compared to short duration ragi variety VR 708 inter cropped with pigeon pea genotypes. Besides Indaf 8 gave higher monetary returns (Rs.10, 982/ha) as sole crop over VR 708 (Rs.8, 475/ha).

Treatments	Finger millet		Pigeon pea		Gross returns (Rs/ha)
	Grain	Straw	Grain	Straw	
Finger millet(FM) sole crop (Indaf 8)	1869	3215	-	-	10,982
FM sole crop (VR 708)	1566	1786	-	-	8,475
Pigeon pea(PP) sole crop (TTB 7)	-	-	848	2823	13,681
PP sole crop (Japan super)	-	-	613	1896	9,669
PP sole crop (AKT 9221)	-	-	687	2074	10,819
PP sole crop (ICPL 87)	-	-	458	1335	7,199
FM + PP 8:2 (Indaf 8 + TTB 7)	1395	1625	447	1517	14,662
FM + PP 8:2 (Indaf 8 + Japan super)	1380	1577	401	1220	13,798
FM + PP 8:2 (Indaf 8 +AKT 9221)	1458	1624	411	1288	14,346
FM + PP 8:2 (Indaf 8 + ICPL 87)	1565	1698	313	923	13,324
FM + PP 8:2 (VR 708 + TTB 7)	1263	1164	410	1240	13,078
FM + PP 8:2 (VR 708 + Japan super)	1094	977	297	918	10,368
FM + PP 8:2 (VR 708 + AKT 9221)	1246	1093	273	846	10,793
FM + PP 8:2 (VR 708 + ICPL 87)	825	738	290	857	8,867
SEm ±					645
CD @ 5%					1875

3. Integrated weed control measures in finger millet

Table 3.1. Grain and straw yield of finger millet as influenced by Integrated Weed Control measures (1994-95)

Treatments	Yield (Kg/ha)	
	Grain	Straw
Chemicals (C)		
No Chemicals	3828 (2088)	4544 (2239)
Anilophos @ 0.4 l a.i./ha pre-emg	0 (922)	0 (922)
2,4-D Na salt 0.75 Kg a.i./ha post-emg	3770 (2076)	4458 (2224)
SEm±	67	41
CD @ 5%	227	86
Mechanical and Cultural measures(M)		
Two Intercultivations	2489 (1680)	2944 (1782)
Two weedings	2344 (1655)	2790(1752)
Two Intercultivations + 1 weeding	2785 (1751)	3267 (1851)
SEm±	67	41
CD @ 5%	NS	NS
CxM interactions		
SEm±	131	77
CD @ 5%	NS	NS

Results : Herbicides viz., Anilophos and 2,4-D sodium salt as pre and post emergence spray were tried in combination with cultural and mechanical measures. Under dryland condition spraying weedicide (2,4-D Na salt at 0.75 Kg ai/ha) did not result in increase in yield (3770 Kg/ha) as compared to no chemicals (3828 Kg/ha). Among mechanical and cultural measures two intercultivation and one hand weeding resulted in higher yield (2785 Kg/ha) than two intercultivations (2489 Kg/ha) or two hand weedings (2344 Kg/ha).

Table 3.2. Grain and straw yield of finger millet as influenced by Integrated weed control measures (1995-96)

Treatments	Yield (Kg/ha)	
	Grain	**Straw**
Chemicals (C)		
No Chemical spray	4286	6021
Isoproturon @ 0.375 kg ai/ha as pre-emg	4549	5812
2,4-D Na salt 0.75 Kg a.i./ha post-emg	4150	5835
SEm±	118	285
CD @ 5%	NS	NS
Mechanical and Cultural measures(M)		
Two Intercultivations(20-25 DAS&35-40 DAS)	4368	6030
Two weedings(20-25 das&35-40 DAS)	4949	6659
Two Intercultivations(20^{th} & 40^{th} DAS) + 1 weeding(30 DAS)	4214	5842
No cultural/mechanical measures	3778	5025
SEm±	136	233
CD @ 5%	282	483
CxM interactions		
SEm±	236	404
CD @ 5%	NS	NS

Results : Application of Isoproturon at 0.375 kg ai/ha gave higher yield (4549 kg/ha) than without spray (4286 kg/ha). However, spraying of 2,4-D at 0.75 kg ai/ha slightly reduced the yield (4150 kg/ha). Mechanical control by hand weeding twice resulted in higher yield (4949 kg/ha). Lowest yield (3778 kg/ha) was recorded in no cultural/mechanical measures.

Table 3.3.Grain and straw yield of finger millet as influenced by cropping systems and herbicides in drilled ragi under rainfed conditions. (1995-96)

Treatments	Yield (kg/ha)	
	Grain	Straw
Chemicals (C)		
C_1 : Isoproturon @ 0.375 kg ai/ha as pre-emg	4741	7705
C_2 : Isoproturon @ 0.50 kg ai/ha as pre-emg	4765	7525
C_3 : Anilophos + 2,4-D @ 0.2 l ai/ha as pre-emg	2506	3784
C_4 : Anilophos + 2,4-D @ 0.3 l ai/ha as pre-emg	2121	2874
SEm $\pm$	110	114
CD @ 5%	228	236
Cultural and Mechanical practices (M)		
M_1 : Control (no intercultivation and no weeding)	3276	5268
M_2 : One intercultivation + one hand weeding	3604	5517
M_3 : Two intercultivation + one hand weeding	3720	5632
SEm $\pm$	95	98
CD @ 5%	197	203
Chemicals x Cultural practices		
SEm $\pm$	190	197
CD @ 5%	NS	409

Results : Pre-emergent herbicides were tested along with cultural and mechanical measures to control weeds in dryland finger millet. Application of Isoproturon at 0.5 kg ai/ha gave higher yield (4765 kg/ha) whereas Anilophos + 2,4-D at 0.2 or 0.3 l ai/ha resulted in reduction in yield of the crop (2121 to 2506 kg/ha). Intercultivation twice with one hand weeding gave higher yield (3720 kg/ha) than without any of these practices (3276 kg/ha).

Table 3.4. Grain yield of finger millet as influenced by Integrated Weed Control measures (1996-97)

Treatments	Grain yield (Kg/ha)
Chemicals (C)	
No Chemicals	1560
Isoproturon @ 0.5 kg ai/ha as pre-emg	1757
2,4-D Na salt 0.75 Kg a.i./ha post-emg	1688
2,4-D Na salt + Amelioratives	1730
SEm±	80
CD @ 5%	NS
Mechanical and Cultural measures(M)	
Two intercultivations at 20-25&35-40 DAS	1857
Two intercultivation + one hand weeding	1775
Control (no hand weeding/intercultivation)	1420
SEm±	69
CD @ 5%	202
CxM interactions	
Sem±	139
CD @ 5%	NS

Results : Application of 2,4-D Na salt at 0.75 kg/ha as post-emergence spray (1688 kg/ha) or spraying Isoproturon at 0.5 kg ai/ha as pre-emergence spray (1757 kg/ha) were on par. Two hand weeding (1857 kg/ha) or two intercultivation with one hand weeding (1775 kg/ha) were on par and differed significantly compared to unweeded check (1420 kg/ha). Interaction between chemicals and mechanical measures was not significant.

Table 3.5. Grain and straw yield of finger millet as influenced by Integrated Weed Control measures (1997-98)

Treatments	Yield (Kg/ha)	
	Grain	**Straw**
Chemicals (C)		
C_1 : Control	1492	1968
C_2 : Isoproturon @ 0.5 kg ai/ha pre-emg	1924	2481
C_3 : Isoproturon @ 0.5 kg ai/ha + $CaSO_4$ 1% Solution	1907	2226
C_4 : 2,4-D Na Salt @ 0.75 kg ai/ha post- emg	1573	1945
C_5 : 2,4-D Na Salt @ 0.75 kg ai/ha + $CaSO_4$ 1% solution	1359	1637
SEm $\pm$	123	131
CD @ 5%	356	379
Mechanical and Cultural methods (M)		
M_1 : Two intercultivations (20&40 DAS)	1869	2301
M_2 : M1 + One hand weeding 45 DAS	1845	2163
M_3 : Control (no hand weeding / inter- cultivation)	1240	1770
SEm $\pm$	96	101
CD @ 5%	278	292
C x M interaction		
SEm $\pm$	192	202
CD @ 5%	NS	NS

Results: Pre-emergence application of Isoproturon @ 0.5 kg ai/ha was significantly superior (1924 kg/ha) compared to control (1492 kg/ha) and 2,4-D Na salt @ 0.75 kg ai/ha as post-emergence (1573 kg/ha), Use of ameliorative viz., calcium sulphate at 1% spray had no much effect on yield as well as phytotoxicity.

3.1. Screening of herbicides in finger millet based cropping systems under dry land conditions.

Table 3.1.1. Grain and straw yield as influenced by cropping systems and herbicides in drilled ragi under rainfed conditions. (1994-95)

Treatments	Yield (kg/ha)			
	Grain		Straw	
Cropping system (C)				
C_1: Sole crop	(2276)	1817	(2570)	2695
C_2: Mixed crop	(2382)	1822	(2427)	2310
SEm ±	14	-	7	-
CD @ 5%	NS	-	NS	-
Herbicides (H)				
H_1: Anilophos at 0.4 l a.i./ha pre-emg.	(1662)	155	(1587)	-
H_2: Isoproturon @ 0.75 kg a.i./ha pre-emg.	(2669)	2907	(2969)	3883
H_3: Fluchloralin @ 0.75 kg a.i./ha pre-emg.	(1671)	177	(1587)	-
H_4: Metalochlor @ 1 l a.i./ha pre-emg.	(1687)	212	(1587)	-
H_5: 2,4, D- Na salt @ 0.75 kg a.i./ha post-emg.	(2546)	2542	(2760)	3170
H_6: Oxadiazon @ 0.75 l ai./ha post-emg.	(2481)	2296	(2747)	3173
H_7: Chlorim uron–ethyl (classic 25 wp) @ 15 g a.i./ha post-emg.	(2446)	2185	(2746)	3173
H_8: Sulfunyl urea (HOE 95404) @ 10 g a.i./ha post-emg.	(2365)	1675	(2736)	3038
H_9: two intercultivation and one weeding	(2636)	3078	(3150)	3725
H_{10}: One intercultivaiton and two weeding	(2742)	3176	(2972)	4506
H_{11}: Control (unweeded check)	(2168)	1658	(2651)	2864
SEm ±	32	-	36	-
CD @ 5%	93	-	104	-
C x H interaction				
SEm ±	47	-	52	-
CD @ 5%	133	-	148	-

* data in parenthesis is square root transformed values

** Crop yield of different akkadi components converted to ragi equivalent yield

Results :

Pre and post emergent chemicals were tested in pure and mixed (Akkadi) cropping systems of finger millet under rainfed conditions.

Among pre-emergent weedicides, Isoproturon at 0.75 kg a.i./ha (2907 kg/ha) was found to be effective whereas Anilophos at 0.4 l a.i.,/ha (155 kg/ha), Fluchloralin at 0.5 l a.i./ha (177 kg/ha) and Metalochlor at 1 l a.i./ha (212 kg/ha) were found to be phytotoxic. Among post emergence weedcides only 2, 4-D Na salt at 0.75 kg a.i./ha (2542 kg/ha) was found to be effective whereas other chemicals viz., Oxadiazon at 0.75 l a.i./ha (2296 kg/ha) chlorim-uron ethyl (classic 25 wp) at 15 g ai/ha (2185 kg/ha) and sulfulyl urea (HOE 95404) at 10 g a.i./ha (1675 kg/ha) were found to be not effective in controlling weeds as compared to standard cultural practice and weeding (3078 to 3176 kg/ha). Unweeded control (1658 kg/ha) resulted in 48 % reduction in yield compared to standard cultural practice (3176 kg/ha).

Table 3.1.2. Yield of finger millet as influenced by different herbicides under rainfed conditions (1996-97)

Treatments	Yield (kg/ha)	
	Grain	Straw
1. Isoproturon @ 0.5 kg ai/ha pre-emg(PE)	3046	2963
2. Classic @ 12 g ai/ha as PE	2592	2094
3. Ally @ 9 g ai/ha	3110	2657
4. Classic @ 6 g ai/ha as early post emg(EPE) 7-8 DAS	2707	3014
5. Ally @ 4 g ai/ha as EPE	2874	1418
6. DPX 2,4-D Na salt 0.75 kg ai/ha as EPE	3040	2298
7. Butachlor @ 0.75 ai/ha as EPE	1686	894
8. 2,4-D Na salt @ 0.75kg ai/ha as post-emg (15-20 DAS)	3438	2707
9. Isoproturon @ 0.5 kg ai/ha + Classic @ 9 g ai/ha as EPE	2989	3014
10. Isoproturon @ 0.5 kg ai/ha + Classic 6 g ai/ha as EPE	2989	2452
11. Isoproturon @ 0.5 kg ai/ha + Ally 9 g ai/ha as EPE	2061	1656
12. Isoproturon @ 0.5 kg ai/ha + Ally 4 g ai/ha as EPE	2975	2605
13. Hand weeding twice (25&45 DAS) + one intercultivation (20 DAS)	2733	1507
14. Unweeded check	2018	2554
15. Isoproturon 0.5 kg ai/ha + DPX 2,4-D Na salt 0.375 kg ai/ha as EPE	2569	2248
SEm $\pm$	249	427
CD @ 5%	720	1236

Results: Pre-emergence and post emergence herbicides were tested alone or in combination with cultural and mechanical measures to control weeds in dryland finger millet.

Among the herbicides screened, 2,4D Na salt at 0.75 kg ai/ha (3438 kg/ha) and Isoproturon at 0.5 kg ai/ha as pre-emergence (3046 kg/ha) were effective than the other combinations tried. Butachlor at 0.75 kg ai/ha as early post-emergence spray was phytotoxic to the crop (1686 kg/ha) resulting in lower yield than unweeded check (2018 kg/ha).

3.2 Use of Isoproturon to control weeds in finger millet under dry land condition

Yield (kg/ha) of finger millet as influenced by the use of Isoproturon and its method of application

Treatments	Yield (kg/ha)					
	98-99		99-00		Mean	
	Grain	Straw	Grain	Straw	Grain	Straw
Pre-emg application of Isoproturon WP at 0.5 Kg ai/ha						
T_1: Spray	5114	9596	2259	3175	3687	6386
T_2: Mixed with sand & applied	4560	8964	1857	3241	3209	6103
T_3: Mixed with soil & applied	4694	8712	2403	3135	3549	5924
T_4: Mixed with $CaSO_4$&applied	4910	9722	2006	3267	3458	6495
Pre-emg application of Isoproturon SE at 0.5 kg ai/ha						
T_5: Spray	4390	8838	1777	3486	3084	6152
T_6: Mixed with sand & applied	4129	9216	1986	3201	3058	6209
T_7: Mixed with soil & applied	4353	9216	1895	3373	3124	6295
T_8: Farmers practice-two IC 20&40 DAS, one hand weeding 35 DAS	5246	8207	1913	3379	3580	5793
T_9: Unweeded check	3310	7323	1344	7579	2327	4951
SEm $\pm$	229	491	209	173		
CD @ 5%	686	NS	NS	NS		

Results: …..

4. Yield maximization trial in finger millet under rainfed conditions.

Grain and straw yield (Kg/ha) of finger millet as influenced by production components to maximise the yield (1994-95)

Treatments	Yield (Kg/ha)	
	Grain	**Straw**
1. Local variety with local practices	2216	2671
2. Local variety with rec. practices excluding plant protection (PP) measures	2629	3095
3. Improved variety with local practices	3108	3450
4. Improved variety with rec. practices excluding PP measures	3878	4460
5. Local variety with 50% RDF* + other rec. practices excluding (PP) measures	2143	2904
6. Improved variety with 50% RDF + other rec. practices excluding PP measures	3239	3888
7. Improved variety with rec. practices& plant protection PP measures	-	-
SEm±	134	199
CD @ 5%	416	614

*RDF-Recommended dose fertilizer

Results : Different production components were tested for their contribution to the yield. With the improved management practices PR 202 (3878 Kg/ha) gave 47 per cent higher yield than local Hullubele (2629 Kg/ha). Increase in yield due to better management practices was 4.5 and 24.5 per cent with local and improved variety, respectively. Reducing the fertilizer dose to 50 per cent yielded 19.8 per cent less. Similar trend in respect of straw yield was noticed. These results are in confirmation with the results of previous years.

5. Agronomic investigations for the late sown finger millet.

Grain and straw yield as influenced by varieties, method of establishment and plant population under late sown condition. (1994-95)

Treatments	Yield (kg/ha)	
	Grain	Straw
Varieties (V)		
Indaf 9	2493	4090
HR 374	2381	3567
Indaf 8	2740	4694
SEm ±	68	186
CD @ 5%	200	544
Method of establishment and spacing (M)		
Drilling at		
22.5 x 7.5 cm	1739	3372
30.0 x 7.5 cm	1622	3074
Transplanting at		
22.5 x 7.5 cm	3318	4923
30.0 x 7.5 cm	3472	1599
SEm ±	79	214
CD @ 5%	231	628
V x M interaction		
SEm ±	131	371
CD @ 5%	NS	NS

Results : Finger millet varieties viz. HR 374, Indaf 9 and Indaf 8 were drilled or transplanted on September 23rd with different row spacing (22.5 and 30 cm).

Among the varieties tried, Indaf 8 gave higher yield (2740 Kg/ha) than Indaf 9 (2493 kg/ha) and HR 374 (2381 Kg/ha). Transplanting gave higher yield (3472 kg/ha) than drilling (1622 kg/ha). Varying row spacing did not result in significant difference in yield.

Grain and Straw yield as influenced by varieties, method of establishment and time of sowing under late sown conditions (1995-99)

Treatments	Yield							
	1995-96		1997-98		1998-99		Mean	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
Vatieties								
Indaf 8	5006	8436	2289	4655	3276	7100	3524	6730
PR 202	5523	8493	2950	5108	3621	6446	4031	6682
Indaf 9	4714	6603	2063	4221	3043	5980	3273	5601
GPU 28			2678	4602	3961	6219	3170	5411
GPU 26			2698	4871	3421	4706	3060	4789
L5			2761	5099	4615	6909	3688	6004
SEm ±	130	236	70	-	-	-		
CD @ 5%	510	927	240	-	234	269		
Sowing (S)								
Normal	6200	9129	3080	5771	4462	8006	4581	7635
20-25 days after normal	3961	6559	2280	4240	4130	6778	3457	5859
35-40 days after normal			2359	4267	2378		2369	4333
SEm ±	126	99	77	-	-	-		
CD @ 5%	436	343	215	-	139	579		
Method of Establishment (M)								
Drilling	4360	7077	2522	4716	3485	6248	3456	6014
Transplanting	5802	8620	2624	4802	3827	6537	4084	6653
SEm ±	153	148	167	-	-	-		
CD @ 5%	471	456	NS	-	115	243		

Results:….

Yield of finger millet as influenced by nutrient management and moisture conservation practices for late sown rainfed situations. (1994-95)

Treatments	Yield (Kg/ha)	
	Grain	Straw
T_1: 75 % RDF* and N in two splits	1731	2778
T_2: 75 % RDF and N in three splits	1418	2556
T_3: 100 % RDF and N in two splits	1867	3074
T_4: 100 % RDF and N in three splits	1590	2481
T_5: 125 % RDF and N in two splits	1650	3000
T_6: 125 % RDF and N in three splits	1964	3111
T_7: Rec. practices + opening a furrow	2127	3407
T_8: Rec. practices + 3-4 intercultivations	1568	2481
T_9: Rec. practices + one protective irrigation	2616	3741
T_{10}: Rec. practices + two protective irrigation	2755	3667
SEm $\pm$	144	212
CD @ 5%	340	629

*RDF : 50:40:25 kg N, P_2O_5, and K_2O/ha

Results : Giving one or two protective irrigation enhanced the yield substantially (2616-2755 kg/ha) than the recommended management practice (1867 kg/ha) and was ranked third best. Varying the fertilizer dose from 75 to 125% of the recommended did not increase the yield considerably (1731 to 1964 kg/ha).

6. Investigations on alternate source of nutrients in maintaining productivity of finger millet

Grain and straw yield of finger millet as influenced by different sources of nutrients under rainfed conditions.

Treatments	Yield (kg/ha)								Mean	
	94-95		95-96		96-97		97-98			
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
Biofertilizers (B)										
B_0: Control (no seed inoculation)	2767	2201	1910	2926	1222	1121	1617	2171	1879	2105
B_1: Seed inoculated with *Azospirillum brasilense* + *Aspergillus awamori* (@ 25 g each per kg of seeds)	2790	2598	1975	2878	1463	1185	1867	2569	2024	2308
SEm ±	82	53	64	55	40	84	46	90		
CD @ 5%	NS	158	NS	NS	119	NS	135	263		
Nutrient sources (N)										
N_1: Only FYM to provide 50 Kg N (5 t/ha)	1883	1640	1149	2116	730	626	720	1227	1121	1402
N_2: 25 kg N through FYM (2.5 t/ha) + 25 kg N (inorganic) + P and K	2940	2354	2177	3082	1668	1021	2112	2119	2224	2144
N_3: RDF *(50:40:25 kg NPK/ha)	3056	2606	2291	3307	1886	1341	2752	4129	2496	2846
N_4: Farmers practice – 5 t FYM/ha + 50 % N and P	3034	2672	1948	2964	1350	1214	2122	2783	2114	2408
N_5: 75 % RDF (37.5:30:18.75 kg/ha)	2979	2725	2149	3043	1080	1386	2289	2894	2124	2512
N6: Absolute Control							458	991	458	991
SEm ±	130	83	101	88	63	108	80	155		
CD @ 5%	285	250	300	184	187	321	235	454		
B x N interaction										
SEm ±	183	119	143	124	88	153	113	219		
CD @ 5%	NS	354	NS	NS	NS	NS	NS	NS		

*RDF-Recommended dose fertilizer

Results:….

7. Nutrient management for finger millet based cropping system

Yield and monetary returns as influenced by the crop rotation and fertilizer management under rainfed condition

Crop rotation			Yield (kg/ha)						Total monetary returns (Rs/ha)
			1994		1995		1996		
1994	**1995**	**1996**	**Grain**	**Straw**	**Grain**	**Straw**	**Grain**	**Straw**	
Ragi	Ragi	Ragi	2089	1466	2815	3245	1677	1319	35,629
Ragi	Groundnut	Ragi	2191	1540	1067	-	2087	1876	35,341
Ragi	Maize	Ragi	2104	1503	2599	3321	2168	1840	33,968
Ragi	Sunflower	Ragi	2205	1543	665	1735	2197	1982	29,855
Ragi	Pigeon pea	Ragi	1669	1328	875	-	2353	2049	35,225
SEm ±							59	44	1173
CD @ 5%							192	145	3825
Nutrient Management									
F1:FYM 5 t/ha			1285	931	1247	1784	1433	1034	23,755
F2:FYM 2.5t/ha + 50% RDF			2048	1286	1515	2373	2011	1775	32,541
F3:FYM 5 t/ha + 100% RDF			2457	1632	1576	2766	2762	2435	39,427
F4:50% RDF			2165	1739	1762	3336	1818	1602	34,786
F5:100% RDF			2303	1794	1921	3576	2396	2219	39,511
SEm ±							54	78	469
CD @ 5%							155	223	1340
Crops x Fertilizers									
SEm ±							121	174	1047
CD @ 5%							347	498	2992

Results : Highest grain yield of finger millet (2353 kg/ha) was obtained in ragi-pigeon pae – ragi) crop rotation followed by ragi-sunflower-ragi (2197 kg/ha). Monocropping of finer millet resulted in lower yield (1677 kg/ha). Stow yield also followed the similar trend. On the basis of total monetary returns it was observed that ragi-sunflower-ragi resulted in lower returns (Rs.29,855.00 /ha) followed by ragi-maize-ragi (Rs.33,968.00/ha). Returns from other crop sequences varied from Rs.35,225 to Rs.35,629/ha.

Nutrient management for finger millet based cropping system (Grain yield kg/ha)

Nutrient treatment	*Kharif* 1996	*Kharif* 1997				*Kharif* 1998(Ragi)				Nutrient management for Ragi (*kharif* 1998)				Mean
	Ragi	Ragi	G.nut	S.flower	Maize	R-R-R	R-G-R	R-S-R	R-M-R	No fert.	50% rec fert.	100% rec fert.	Fert. Based on STV*	
NPK fert. Alone	2562 (3941)	2531 (3715)	1128 (2891)	717 (1700)	2316 (6070)	1666 (2698)	2042 (3290)	1829 (2969)	1860 (3022)	733 (1172)	1781 (2936)	2314 (3754)	2570 (4116)	1849 (2995)
NPK + FYM	3068 (4602)	3179 (4851)	1241 (3951)	1105 (2131)	2669 (8416)	2144 (3203)	2780 (4202)	2557 (3854)	2308 (2415)	1287 (1937)	2284 (3402)	2972 (4468)	3245 (4867)	2447 (3668)
Mean						1905 (2950)	2411 (3746)	2193 (3411)	2084 (3218)	1010 (1555)	2033 (3169)	2644 (4111)	2908 (4491)	

	Organic manure	Crop rotation	Fertilizers doses
SEm+	107(180)	58(104)	54(80)
CD (5%)	442(480)	180(320)	153(227)

Figures in the parenthesis indicate straw/stalk (kg/ha)
*STV = Soil Test Value

Results : Higher yield of finger millet was obtained with the addition of FYM (2447 kg/ha) than without FYM (1849 kg/ha). Mono-cropping of finger millet resulted in lower yields (1905 kg/ha) whereas the yield of finger millet was enhanced (2411 kg/ha) when finger millet was rotated with groundnut in the previous season. Finger millet yield at all the levels of fertilizers was higher with the addition of FYM than without FYM. Lowest yield of finger millet was recorded when no fertilizers were given (1010 kg/ha) while higher yield (2908 kg/ha) was obtained in plots which received fertilizers as per soil test values followed by recommended fertilizers application (2644 kg/ha).

Nutrient management for finger millet based cropping system

Organic matter (Main plot): M_0: No FYM
M_1: 7.5 t/ha FYM

Crop rotation (Sub plot):

	I year	**II year**	**III year**
C_1	Finger millet	Finger millet	Finger millet
C_2	Finger millet	Ground nut	Finger millet
C_3	Finger millet	Sunflower	Finger millet
C_4	Finger millet	Maize	Finger millet

Fertilizer levels (Sub-sub plot) : Fo : No fertilizer
F1 : 50 % RDF
F_2 : 100 % RDF
F_3 : Fertilizer based on soil test crop response value (STCR)

Grain yield of crops as influenced by fertility gradients and farm yard manure during *Kharif* 1999 under rainfed conditions.

Treatments	Ragi			Groundnut			Sunflower			Maize			Gross Monetary Returns (Rs/ha)		
	M_o	M_1	Mean	M_o	M_1	Mean	M_o	M_1	Mean	M_o	M_1	Mean	M_o	M_1	Mean
F_0: No fertilizer	1519	1988	1754	764	1251	1008	177	684	431	1297	1835	1566	7217	11674	9446
F1: 50% Rec. fertilizer	2292	2710	2501	954	1382	1168	698	895	797	2521	3990	3256	11952	16209	14081
F_2: 100% Rec. fertilizer	2856	3223	3041	1316	1505	1411	745	1149	947	3600	4783	4192	15473	19005	17239
F_3: Fertilizer based on test value	2861	3252	3057	1329	1498	1414	832	1620	1226	3823	4944	4384	16035	23580	18308
Mean	2382	2793		1089	1409		613	1087		2810	3888		12579	16867	

Gross monetary returns (Rs/ha) as influenced by crops, FYM levels and fertility gradients during *kharif* 99 under rainfed condition

Treatments	Ragi			Groundnut			Sunflower			Maize		
	M_o	M_1	Mean	M_o	M_1	Mean	M_o	M_1	Mean	M_o	M_1	Mean
Fo: No fertilizer	11205	14825	13015	9171	15498	12335	1943	7524	4734	6548	8849	7699
F1: 50% Rec. fertilizer	16864	20556	18701	11450	16581	14016	7678	9843	8761	11815	17855	14835
F2: 100% Rec. fertilizer	21362	23747	22555	15795	18058	16927	8198	12716	10457	16536	21499	19018
F3: Fertilizer based on test value	21317	24179	22748	15846	17979	16913	9154	17819	13487	17821	22343	20082
Mean	17687	20826	19256	13066	17029	15048	6743	11976	9360	13180	17637	15408

	FYM (M)	Crops (C)	Fertilizer (F)	M x C	M x F	C x F	M x C x F
SEm±	31	81	81	114	114	161	228
CD @ 5%	86	225	225	319	NS	451	NS

Grain yield (Kg/ha) as influenced by nutrient management in finger millet based cropping systems

Treatments	*Kharif* 96	*Kharif* 97				*Kharif* 98	*Kharif* 99			
	Ragi	Ragi	Groundnut	Sunflower	Maize	Ragi	Ragi	Groundnut	Sunflower	Maize
Rec. NPK alone	2562 (3941)	2531 (3715)	1128 (2891)	717 (1700)	2316 (6070)	1849 (2995)	2382	1089	613	2810
NPK + FYM	3068 (4602)	3179 (4851)	1241 (3951)	1105 (2131)	2669 (8416)	2447 (3668)	2793	1409	1087	3888
Mean	2815 (4271)	2855 (4283)	1185 (3421)	911 (1916)	2493 (7243)	2148 (3332)	2587	1249	850	3349

Figures in parenthesis indicate straw/stalk yield; M_o = No FYM, M_1 = 7.5 t of FYM/ha; **Selling prices (Rs/Kg)** : Ragi- 6.00 (Grain), 1.20 (Fodder); Ground nut- 12.00; Sunflower – 11.00; Maize- 4.00 (Grain), 0.50 (Fodder).

Results: At Bangalore, nutrient management in finger millet based cropping system was initiated during 1996. In *Kharif* 99, four crops viz., ragi, groundnut, sunflower and maize were raised with and without FYM and graded level of inorganic fertilizers.

Based on the monetary value, monocrop of ragi brought higher returns (Rs.19, 256/ha) whereas sunflower brought lower returns (Rs.9, 360/ha). All the crops gave higher returns when organic and inorganic fertilizers were applied together than inorganic fertilizer alone. Further, higher returns were obtained when nutrient management was based on soil test crop response value than the blanket recommendation.

8. Studies on response of finger millet varieties under low fertility conditions.

Yield (Kg / ha) of finger millet varieties as influenced by different fertility gradients under rainfed condition.

Treatments	Yield (kg/ha)						
	97-98	98-99		99-00		Mean	
	Grain	Grain	Straw	Grain	Straw	Grain	Straw
Fertility gradients (F)							
F1 = No fertilizer	544	3866	5029	2582	3321	2331	4175
F_2 = F1 + bi-fertilizer (BF) inoculation	670	3879	5453	2829	4113	2459	4783
F_3= F2 + 50% rec. fertilizer	1336	4195	5796	4037	5873	3189	5835
F_4 = F2 + 25% rec. fertilizer	1529	4163	5624			2846	5624
F_5 = 100 % Rec. NPK (50:40:25 kg /ha)	-	4560	5807			4560	5807
F_6 = 50% Rec. NPK	-			3805	4941	3805	4941
F_7 = 25% Rec.NPK + 25% Rec. FYM	-			3369	5126	3369	5126
F_8 = F7 + F2	-			3857	5548	3857	5548
SEm ±	-	123	261	141	309		
CD @ 5%	-	348	NS	445	972		
Varieties (V)							
V_1 :Indaf 8	1073	4588	6811	3206	4844	2956	5828
V_2: L 5	1656	5102	6088	3894	4694	3551	5351
V_3: L 15-1	1245	-				1245	
V_4 : PR 202	1579	4939	6337	3322	4716	3280	5527
V_5 : HR 911	1286					1286	
V_6 : GPU 28	926	4181	5514	3676	4900	2928	5207
V_7 : Indaf 5	830					830	
V_8 : HR 374	402	3621	4588	3230	5006	2418	4797
V_9 : VR 708	386	3438	4650	2879	4784	2234	4717
V_{10} : Indaf 9	892	3515	6049	3177	4873	2528	5461
V_{11}: GPU 26	941	4416	5103	4070	4767	3142	4935
V_{12}: VL 149	-	3395	4815	3208	4793	3302	4804
SEm ±	-	165	350	93	102		
CD @ 5%	-	464	1006	262	NS		
F X V (Interaction)							
SEm ±		370	784	229	249		
CD @ 5%		NS	NS	NS	NS		

Results: ……

9. Investigation on plant density and fertilizer levels on pre-release variety GPU 28.

Grain and straw yield of finger millet variety GPU 28 as influenced by spacing and fertilizer levels.

Treatments	Yield (kg/ha)					
	94-95		95-96		Mean	
	Grain	Straw	Grain	Straw	Grain	Straw
Spacing (cm)						
22.5 x 5.0 (8.89 lakhs lants/ha)	3556	4385	4010	7639	3783	6012
22.5 x 7.5 (5.92 lakhs plants/ha)	3892	4634	4717	9675	4305	7155
22.5 x 10.0 (4.44 lakhs plants/ha)	3907	4510	4473	8798	4190	6654
30 x 5.0 (6.67 lakhs plants/ha)	3581	4348	4176	8234	3879	6291
30 x 7.5 (4.44 lakhs plants/ha)	3808	4590	4264	8299	4036	6445
SEm $\pm$	148	175	152	309		
CD @ 5%	NS	NS	319	649		
Fertilizer levels (kg/ha)						
50:40:25	3624	4316	4413	8475	4019	6396
62.5:50:37.25	3874	4671	4243	8582	4059	6627
SEm $\pm$	94	111	97	195		
CD @ 5%	278	328	NS	NS		
Spacing x Fertilizer interactions						
SEm $\pm$	209	247	216	437		
CD @ 5%	NS	NS	NS	NS		

Results :…..

10. Farmyard manure enrichment and methods of application for its efficient use in finger millet production

Yield (Kg/ha) of finger millet as influenced by FYM enrichment and method of application (1999-2000)

Treatment	Yield (kg/ha)	
	Grain	Straw
Fertility gradient		
F_1: 50 % Rec. NPK	2122	3118
F_2: 100 % Rec. NPK	2261	3389
F_3: 150% Rec. NPK	2965	3790
SEm±	53	59
CD @ 5%	154	168
Enrichment levels and method of application		
E_1: 2.5t FYM as brad casting + No NPK	1952	3079
E_2: 2.5t FYM as band placement + No NPK	2259	2977
E_3: 2.5t FYM enriched with $F_1/F_2/F_3$ fertilizer with broad casting	2479	3567
E_4: E_3 with band placement	3006	3800
E_5: 7.5 t FYM as broad casting + No NPK	2093	3464
E_6: 7.5t FYM as band placement + No NPK	2320	3004
E_7: 7.5t FYM enriched with $F_1/F_2/F_3$ fertilizer + broad casting	2543	3683
E_8: E_7 with band placement	2755	3717
E_9: NPK ($F_1/F_2/F_3$) fertilizer alone	2636	3601
SEm±	147	245
CD at 5%	418	NS
Fertility x Enrichment		
SEm±	257	423
CD at 5%	NS	NS

Results: At Bangalore, application of graded level of inorganic fertilizer from 50% to 150% showed increasing trends in grain yield (2122 to 2965 Kg/ha). Enrichment and method of application of FYM revealed that band placement of FYM was better than broad casting and also there was not much difference in grain yield with 2.5 and 7.5 t FYM/ha. The trial will be continued for confirmation of results.

11. Fodder yielding potential of small millets under dry land conditions

Treatments

Crops :	**Cutting stage**
1) Finger millet - Local (Hullubale)	C_1: Harvesting at maturity for grain and fodder
2) Finger millet - Improved (Indaf 8)	C_2: Cutting 2-3" above ground at flowering stage (allowing it for fodder).
3) Barnyard millet - VL 29	C_3: C_2+Ratooning and harvesting at dough stage (for grain purpose)
4) Little millet - PRC 3	

T_1 = Finger millet local variety both for grain and fodder harvesting at maturity (C_1).
T_2 = Finger millet improved variety both for grain and fodder harvesting at maturity (C_1).
T_3 = Little millet variety both for grain and fodder harvesting at maturity (C_1).
T_4 = Barnyard millet variety both for grain and fodder harvesting at maturity (C_1).
T_5 = Finger millet variety local for cutting 2-3" above ground (C_2) at flowering stage cutting for green fodder.
T_6 = Finger millet variety local for (C_3) ratooning and harvesting at dough stage
T_7 = Finger millet variety improved for cutting 2-3" above ground at flowering stage (C_2).
T_8 = Finger millet variety improved for (C_3) ratooning and harvesting at dough stage
T_9 = Barnyard millet for cutting 2-3" above ground at flowering cutting for green fodder (C_2)
T_{10} = Barnyard millet for (C_3) ratooning and harvesting at dough stage
T_{11} = Little millet for cutting 2-3" above ground at flowering stage and cutting for green fodder (C_2)
T_{12} = Little millet for (C_3) ratooning and harvesting at dough stage.

Grain (Kg/ha), fodder yield (Kg/ha) and monetary returns (Rs./ha) of small millets as influenced by crops and stage of cutting (1999-2000)

Treatment	**Yield(kg/ha)**		
	Grain	**Straw**	**GMR**
T_1	1938	9683	23250
T_2	2999	6730	26071
T_3	380	8465	7869
T_4	423	9920	9242
T_5	-	11503	13803
T_6	-	10139	12166
T_7	-	7431	8917
T_8	-	8312	9974
T_9	-	11972	8959
T_{10}	-	9875	7406
T_{11}	-	11703	8778
T_{12}	-	11475	8608
SEm±			1409
CD at 5%			NS

GMR = Gross Monetary Returns

Results: At Bangalore centre local, Hullubele gave lower grain yield but higher straw yield (9683 Kg/ha) but it was (1938 Kg/ha) vice-versa in high yielding finger millet variety Indaf 8.However, Indaf 8 was superior (Rs.26071/ha) over Hullubele (Rs.23250/ha) in respect of gross monetary returns. Returns from barnyard millet or little millet were far lower than finger millet crop. Green fodder yield of all the three small millets were on par (9875 to11972 Kg/ha).

12. Moisture management practices for late sown finger millet.

Grain yield of late sown finger millet as influenced by moisture management (1998-99)

Treatments	Yield (kg/ha)	
	Methods of Establishment	
	Drilled	Transplanted
Rec. cultivation practices (RCP)	1352	1444
RCP + Opening a dead furrow at 3m interval	1704	1889
RCP + addition of organic matter (15t/ha)	2463	2870
RCP + extra intercultivation	1981	2185
RCP + Acilol mulch at 30&60 DAS	1611	1981
RCP + stuble mulching	2222	2574
RCP + Protective irrigation during dry spells	2981	3185
Mean	2045	2304

Results: *In-situ* moisture conservation practices were followed to minimize the adverse effects of moisture stress. Among the treatments one protective irrigation recorded highest yield (3083 kg/ha) followed by addition of organic manure at 15 t/ha (2463 kg/ha). Spraying of *Acilol* did not enhance the crop yield substantially.

13. Response of foxtail millet varieties to different levels of nitrogen under rainfed conditions.

Yield of foxtail millet as influenced by varieties and nitrogen levels under rainfed conditions

Treatments					Yield (kg/ha)											
					94-95		95-96		96-97		97-98		99-00		Mean	
					Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
Varieties (V)																
94-95	**95-96**	**96-97**	**97-98**	**99-00**												
SIA 2622	SIA 2622	PS 1	TNAU 182	GPUS 25	984	2219	1621	4105	973	1323	524	1173	529	3738		
SIA 2634	SIA 2634	PS 4	GPUS 25	TNAU 193	1127	2446	2033	5452	1320	1488	589	1219	744	3378		
SIA 2669	SIA 2669	SIA 326	PS 4	TANU 190	1170	2926	2007	3370	799	1185	-	-	807	3729		
SIA 326	SAI 326		SIA 326	TNAU 196	1063	2347	1511	3215			522	1273	1048	3979		
				SAI 326									713	3686		
SEm ±					84	122	64	148	79	109	41	33	61	146		
CD @ 5%					NS	353	185	426	237	NS	NS	98	194	NS		
Nitrogen (kg/ha) (N)																
0					658	1956	1315	3483	733	992	236	636	977	3554	784	2124
20					1084	2652	1717	3926	1061	1543	426	1342	767	3750	1011	2643
40					1197	2505	1890	4029	1298	1460	938	1365	961	3801	1257	2632
60					1405	2826	2250	4704							1878	3765
SEm ±					84	122	64	148	79	109	41	33	52	189		
CD @ 5%					243	353	185	426	237	327	123	98	150	NS		
V x N interaction																
SEm ±					168	244			138	189	71	57	116	327		
CD @ 5%					NS	705			NS	NS	NS	NS	NS	NS		

Results:….

II. DEMONSTRATIONS

1994-95

1. Studies on running wooden roller for covering the finger millet seeds after sowing under dry land conditions.

Crust strength as influenced by seed covering methods in finger millet

Treatments	Crust strength (kg/cm²)					
	3.8.94		5.8.94			
	Field 1		Field 1		Field 2	
	Btn. Rows	In rows	Btn. Rows	In rows	Btn. Rows	In rows
Manual covering	2.81	1.30	3.44	2.25	0.44	0.72
Brush harrow	1.31	0.81	>4.5	1.19	-	-
Wooden roller	1.40	1.05	>4.5	2.64	1.58	0.60

Moisture per cent and number of gaps (> 10 cm) in 10 m row length

Treatments	Moisture (%)		No. of gaps Av. of 10 rows
	0-15 cm	15-30 cm	
Wooden roller	7.6	10.8	9.3
Brush harrow	8.1	8.2	16.6

Results : A feeler trial on use of wooden roller to cover finger millet seeds was initiated. A wooden roller (1.6 m length, 20 cm radius and 39 kg weight) was fixed to a iron frame (13 kg) and it was passed after sowing to cover the seeds.

Finger millet was sown using seed cum fertilizer drill. The seeds were covered manually or by using wooden roller or brush harrow. Crust strength, soil moisture and gaps in germination were recorded. Crust strength was more in plots where wooden roller was used than in brush harrow. Moisture content was slightly higher at soil depth of 15-30 cm in plots where wooden roller was used. More gaps in plant stand were noticed by using brush harrow than wooden roller.

2. Varietal performance

Grain and straw yield of finger millet varieties under rainfed conditions

Varieties	Days to maturity	Yield (Kg/ha)	
		Grain	Straw
Indaf 8	124	6104	8889
Indaf 9	108	5534	7778
HR 911	118	6444	6667
HR 50-5	124	6178	7778
GPU 26	116	5843	8889
GPU 28	115	6960	8333
MR 1	124	6021	9444

Results : Finger millet varieties viz., MR 1, Indaf 8, Indaf 9, HR 911, HR 50-5, GPU 28 and GPU 26 were grown with recommended package of practices under rainfed conditions.

Among the varieties, GPU 28 (6960 Kg/ha) gave the highest yield followed by HR 911 (6444 Kg/ha). The next best varieties were HR 50-5 (6178 Kg/ha) and Indaf 8 (6104 Kg/ha).

3. Comparative performance of finger millet based cropping system

Yield and gross returns as influenced by cropping systems and management practices

Cropping Systems	Yield of Crops(Kg/ha)		Gross returns (Rs/ha)
Ragi pure crop	Grain :	3114	14522
	Straw :	5494	
Ragi + Pigeon pea (8:2)	Ragi Grain :	2398	13521
	Ragi Straw :	3738	
	PP Grain :	186	
	PP Stalk :	283	
Ragi + Akkadi (6:1)	Ragi Grain :	1682	11442
	Ragi Straw :	2431	
	Niger :	27	
	Mustard :	6	
	Jowar green fodder :	4162	
	PP Grain :	12	
	PP Stalk :	53	

Results : Under higher level of management pure crop of finger millet was found to be advantageous. Higher grain yield (3114 kg/ha) was obtained in advanced method of management (wherein soil and moisture conservation and efficient use of applied fertilizers were given emphasis for pure crop) as compared to farmer's method – Akkadi system (1682 kg finger millet ; Niger 27 kg ; Mustard 6 kg ; Pigeon pea 11.6 kg and Jowar fodder 4.16 kg/ha) while finger millet +pigeon pea (8:2) was intermediate (2398 kg finger millet + 186 kg pigeon pea). Consequently, advance method brought higher gross higher returns of Rs. 14,522/ha than the farmer's method (Rs. 11,442/ha) while inter cropping finger millet and pigeon pea (8:2) was intermediate (Rs. 13,521/ha).

1995-96

1. Varietal performance

Variety	Grain yield (kg/ha)			Straw yield (kg/ha)		
	1994	1995	Mean	1994	1995	Mean
GPU 26	5843	4340	5091	8889	9965	9427
GPU 28	6960	4829	5894	8333	7910	8121
Indaf 5	-	2886	2886	-	9743	9743

Results:

Finger millet varieties viz., GPU 26, GPU 28 and Indaf 5 were grown with recommended package of practices under rainfed conditions.

Among varieties GPU 28 (4829 kg/ha) gave highest yield followed by GPU 26 (4340 kg/ha). Indaf 5, a medium duration variety gave very low yield mainly because of its susceptibility to blast disease.

2. Different sources of nutrients for finger millet

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)
FYM 6.25 t/ha	3111	6060
Vermicompost 7 t/ha	3550	7039
Poultry manure 5 t/ha	4755	9747
RDF* + FYM 7.5 t/ha	3589	7178
RDF (50:40:25 kg NPK/ha)	4082	8694

*RDF-Recommended dose of fertilizer

Results : Finger millet was supplied with 50:40:25 kg N, P_2O_5 and K_2O /ha through different sources of nutrients. Adjustment to supply only 50 kg N/ha was made. Highest grain yield was obtained with the application of poultry manure 5 t/ha (4755 kg/ha) followed by recommended fertilizer application (4082 kg/ha) whereas with only FYM 6.25 t/ha it was low (3111 kg/ha). Application of vermi-compost 7 t/ha or rec. fertilizer and FYM 7.5 t/ha were intermediate (3550 to 3589 kg/ha).

1996-97

1. Varietal performance

Varieties	Yield (kg/ha)	
	Grain	Straw
GPU 26	4308	6281
Indaf 9	2721	6054

Results :

Finger millet varieties viz., GPU 26 and Indaf 9 were grown by adopting recommended package of practices under rainfed conditions. Variety GPU 26 gave higher grain yield (4308 kg/ha) than Indaf 9 (2721 kg/ha). However, straw yield of the varieties did not differ largely (6281 and 6054 kg/ha respectively).

2. Different sources of nutrients for finger millet

Sources of nutrients	Grain yield (kg/ha)
FYM to supply 50 kg N/ha	1467
Poultry manure to supply 50 kg N/ha	2778
Vermicompost to supply 50 kg N/ha	1556
RDF* + FYM	3289
RDF	3000

*RDF- Recommended dose of fertilizer

Results : Finger millet was supplied with 50:40:25 N, P2O5 and K20 kg/ha through different sources of nutrients. Organic source nutrients supplying 50 kg/ha was ensured. Highest grain yield was obtained with application of FYM and fertilizers (3289 kg/ha) followed by fertilizers alone (3000 kg/ha). Among the organic manures poultry manure gave highest yield (2778 kg/ha). Whereas FYM (1467 kg/ha) and vermi-compost (1556 kg/ha) produced low yields.

1997-98

1. Varietal performance

Varieties	Grain yield (Kg/ha)
Indaf 9	2716
GPU 26	3383
Indaf 5	2365
GPU 28	3148

Results : Finger millet varieties viz., GPU 26, GPU 28, Indaf 5 and Indaf 9 were grown by adopting recommended package of practices under rainfed conditions. GPU 26 gave highest yield (3383 kg/ha) followed by GPU 28 (3148 kg/ha). Lowest yield was recorded in Indaf 5 (2365 kg/ha) followed by Indaf 9 (2716 kg/ha).

2. Use of conventional manures in finger millet production

Sources of nutrients	Grain yield (kg/ha)
FYM to supply 50 kg N/ha	2389
Eupatorium compost to supply 50 kg N/ha	3500
Parthenium compost to supply 50 kg N/ha	3250
FYM 7.5 t/ha + 100% NPK (50:40:25 kg/ha)	3694

Results :

FYM, parthenium and eupatorium composts were applied to supply 50 kg N/ha along with a common dose of P_2O_5 and K_2O and compared with 100% application of FYM and inorganic fertilizers as per the package of practices. Among the organic manures tried eupatorium compost recorded highest yield (3500 kg/ha) followed by application of parthenium compost (3250 kg/ha). Whereas combination of both organic and inorganic manures recorded highest yield (3694 kg/ha).

3. Use of Isoproturon as pre-emergence herbicide for rainfed finger millet

Treatments	Grain yield (kg/ha)				
	Isoproturon (kg/ha)				
	0	0.25	0.50	0.75	Mean
Intercultivation (IC) at 25 DAS	3333	3722	3917	3083	3514
IC + one hand weeding at 45 DAS	3944	3778	4217	3167	3776
One hand weeding at 45 DAS	3000	3444	3528	3028	3250
Control (no hand weeding/IC)	2722	3222	3444	2878	3066
Mean	3250	3541	3776	3039	

Results: Pre-emergence application of Isoproturon at 0.5 kg ai/ha gave highest yield (3776 kg/ha) whereas at 0.75 kg ai/ha was found to be slightly phytotoxic (3039 kg/ha) while at 0.25 kg ai/ha crop yield was slightly reduced due to weeds which were not controlled. Besides, giving one intercultivation and one hand weeding recorded highest yield (4217 kg/ha).

1998-99

1. Varietal performance

Varieties	Yield (kg/ha)
Indaf 9	4105
GPU 26	5538
GPU 50	3801

Results : Finger millet varieties viz., Indaf 9, GPU 26 and GPU 50 were grown by adopting recommended package of practices under rainfed conditions. GPU 26 gave highest yield (5538 kg/ha) followed by Indaf 9 (4105 kg/ha).

2. Different sources nutrients for finger millet

Treatment	Yield (kg/ha)
Compost form combinations-vat method	3644
Enrichment compost-vat method	3570
Compost all combinations-pit method	3667
Rec. Fertilizers	4198

Results: Finger millet crop was grown using organic and inorganic source of nutrients revealed that highest grain yield could be obtained due to application of recommended fertilizers (4198 kg/ha). Yield obtained due to application of compost by VAT method (3644 kg/ha) or by pit method (3667 kg/ha) or enriched with rock phosphate (3570 kg/ha) did not differ largely and were lower compared to yields obtained by recommended fertilizers.

3. Use of Isoproturon to control weeds in dryland finger millet

Treatment	Yield (kg/ha)
Farmers practice of two intercultivation and one weeding	4903
Isoproturon at 0.5 kg/ha as pre-emergence + two intercultivation	4996

Results: Pre-emergence of application Isoproturon at 0.5 kg ai/ha was found to be on par (4996 kg/ha) with recommended cultural practice of controlling weeds in finger millet (4903 kg/ha) thus helps in avoiding one hand weeding.

III. CENTER TRIALS

1. Grain yield of finger millet as influenced by different levels of organic and inorganic source of nutrients.

Grain yield of finger millet as influenced by organic and inorganic source of nutrients

Treatments	**Yield (Kg/ha)**
Compost levels	
C_0: No compost	2790
C_1: 2.5 t/ha	3126
C_2: 5t/ha	3431
C_3: 7.5t/ha	3631
CD @ 5%	NS
Fertilizer levels	
N_o: No fertilizer	1215
N_1: 50 % Rec. fertilizer	3662
N_2: 75 % Rec. fertilizer	3930
N_3: 100 % Rec. fertilizer	4149
CD @ 5%	NS
Compost levels x fertilizer levels	
CD @ 5%	NS

Results :

Different dose of compost and various levels of recommended fertilizers on the yield of finger millet were compared. Application of 7.5 t/ha of compost recorded the highest yield of 3610 kg/ha compared to no compost (2790 kg/ha). However, the difference in grain yield between application at 5t/ha (3431 kg/ha) and 7.5 t/ha (3610 kg/ha) did not differ significantly. Full dose of recommended inorganic fertilizer gave the highest yield to the tune of 4149 kg/ha but was statistically on par with 75% recommended dose (3930 kg/ha).

2. Grain yield of finer millet as influenced by different types of compost and two levels of inorganic manures.

Grain yield of finer millet as influenced by compost and levels of fertilizer

Compost	Yield (kg/ha)
1. Compost prepared by VAT method combination of organic wastes	915
2. Compost prepared by VAT method, threshing yard wastes enriched with rock phosphate and microbial culture	2041
3. Compost prepared by VAT method, from threshing wastes without turning cultures and enrichments	1824
4. Compost prepared by pit method, combination of organic wastes	2089
5. Compost prepared by pit method, from threshing yard waste with turning and inoculation	2031
CD @ 5%	NS
Levels of fertilizer	
1. Without inorganic fertilizers	1223
2. 50% rec. fertilizer	2058
3. 100% rec. fertlizer	2679
CD @5%	282

Results: Application of recommended dose of inorganic fertilizers recorded highest grain yield 2679 kg/ha compared to 60 % recommended fertilizer (2058 kg/ha), no fertilizers (1233 kg/ha) and different types of compost. Differences in grain yield due to different types of compost were non significant.

1999-2000

1. Varietal performance:

Date of sowing	Varieties					
	L 5	GPU 28	GPU 26	GPU 46	GPU 52	VL 149
Normal (July last week)	4764	4176	4942	3983	4072	3093
Delayed (19-8-99)	3652	3729	3591	-	-	-
Late (25.9.99)	2732	2417	2373	-	-	-

Results: Finger millet varieties viz., L5, GPU 28, GPU 26, GPU 52 and VL 149 were grown by adopting recommended package of practices under rainfed conditions. GPU 26 gave highest yield (4942 kg/ha) followed by L5 (4764 kg/ha) under normal sowing conditions. Delayed sowing had reduced the yields of finger millet. GPU 28 gave higher yields (3729 kg/ha). However, under further delay in sowing long duration variety L5 performed better (2732 kg/ha)

Small Millets:

Under late sown conditions other small millets viz., proso millet, little millet and foxtail millet were planted in September last week with recommended practices. Sesonal conditions were favourable for late sown crops and yield data is given below.

Crop	Seed yield (Kg/ha)
Proso Millet	1174
Little Millet	841
Foxtail millet	656

Among the other small millets proso millet produced highest yield (1174 kg/ha) followed by little millet (841 kg/ha) whereas setaria gave lower yield (656 kg/ha).

2. Use of Isoproturon to control weeds in dry land finger millet.

Treatments	Seed yield (kg/ha)
Farmers practice of 2 intercultivation and one weeding	4644
Isoproturon @ 0.5 kg ai/ha as pre-emg + two intercultivation	4478

Results: Recommended intercultivations and two weedings (4644 kg/ha) gave higher yield than pre-emergence application of Isoproturon at 0.5 kg ai/ha and two intercultivation (4478 kg/ha).