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CFMV 2 (GIRA): A biofortified, high grain and fodder yielding finger millet (*Eleusine coracana* L. Gaertn) variety

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Abstract

The nationally identified variety 'CFMV 2/ Gira' which is uniform maturing and developed through selection from local germplasm collected from the Dangs district of Gujarat. A finger millet biofortified variety 'CFMV 2/ Gira' was tested as a culture 'WN 559' at the State level and 'FMV 1118' at the National level. It was tested under different state trials at Waghai, Varanasi and Dahod centers in Gujarat from 2014 to 2020. WN-559 (3551 kg/ha) performed well with 15.02 per cent increase over local check 'GNN-6' while, 27.47 and 25.88 per cent grain yield superiority over national check varieties PR-202 and GPU 67, respectively. At the national level, under 28 locations under five states across India under IVT, AVT-I and AVT-II, culture FMV-1118 recorded on an average 2950 kg/ha of grain yield which was 20.7, 32.6, 6.70, 7.70 and 14.4 per cent higher than national checks GPU-45, VL-352, GPU-67, PR-202 and VL-376, respectively in All India Coordinated trials conducted at Andhra Pradesh, Chhattisgarh, Gujarat, Maharashtra and Odisha. Proposed entry 'FMV-1118' yielded 8588 kg/ha of fodder yield with 12.3, 38.8, 11.11, 9.10 and 29.6 per cent increased yield over national checks GPU-45, VL-352, GPU-67, PR-202 and VL-376, respectively. It is medium duration, synchronous maturity (115 to 125 days) with profuse productive tillers and non-lodging culture suitable for rainfed cultivation. The proposed culture was found to be good in nutritional properties particularly high calcium, iron, phosphorous and also a good amount of protein and minerals. With respect to pests and diseases, it was found superior to checks and moderately resistant for the same. It is with bold grain size, non shattering habit of panicle with plant type and non-lodging with semi-compact panicle. Considering the need for medium duration cultivars, the Central Finger Millet Variety (CFMV-2/Gira) a high yield potential genotype with desirable grain quality and moderately resistant to foot rot and blast disease was released by the AICRP-Small Millets, IIMR, Hyderabad as a biofortified and high yielding finger millet variety for the states viz., Andhra Pradesh, Chhattisgarh, Gujarat, Maharashtra and Odisha.

Keywords: Finger millet, Grain yielding variety, High Ca, Fe content, better nutritional quality variety.

INTRODUCTION

Finger millet (*Eleusine coracana* L. Gaertn.) is a crop known for its suitability to dry lands, hills and tribal agriculture especially for food grain and fodder in tribal predominant areas. The crop is hardy and well exhibited its adjustment to different ecological situations due to its ability to complete its life cycle as per changing environmental situations. That makes it an ideal crop for climate change and contingency planning. Finger millet is known for its unique nutritional properties particularly high fiber content, ash, rich source of dietary calcium, iron and mineral compositions. Finger millet has enormous health

benefits and a good source of valuable micro nutrients (Paschapur *et al.*, 2021). The grains are highly nutritious and have excellent grain storage capacity. The stover is a major dry matter source for both draft and milch animals (Patil *et al.*, 2018).

Finger millet commonly known as 'nagli' in Gujarati and 'ragi' in English, is an important staple food after rice, wheat, sorghum and pearl millet in India. It is cultivated under diverse soil and climatic conditions mostly as a rainfed crop. India is a major producer of finger millet

in Asia. During 2018-19, the area occupies under small millets is 1.92 m. ha of which finger millet alone occupies 1.29 m. ha with a production of 2.68 million t and average productivity of 1866 kg/ha. Among all the small millet, finger millet covers about 60 % area and 74 % of the production of India.

The proposed biofortified cultivar was found to have good nutritional properties particularly high calcium, iron, phosphorous and also a good amount of protein, fibre and minerals. With respect to pests and diseases, it was found superior to checks and moderately resistant for the same. Considering the increasing demand for medium duration biofortified cultivar 'CFMV-2 (Gira)' a high yield potential culture, desirable grain quality and moderately resistant to foot rot and blast disease is released for commercial cultivation during ICAR, AICRP-Small Millets, Annual Group Meeting, 2020-21.

MATERIALS AND METHODS

The finger millet genotype 'WN-559' was evolved at Hill Millet Research Station, Navsari Agricultural University, Waghai, Dangs, Gujarat and released as Central Finger Millet Variety (CFMV-2/Gira). It is a pure line selection from the germplasm accession. A single plant with desirable traits, high yield with medium maturing and

resistant to diseases like blast (Leaf, Neck and Panicle) and pest like stem borer was forwarded as a single plant to progeny rows. The promising culture was evaluated over eight years at the Waghai location with checks including multilocation trials at Waghai, Vanarasi and Dahod starting from 2017-18 to 2020-21 and also tested in ICAR, All India Co-ordinated trials under AICRP-Small millets in five states across 8 locations from 2017-18 to 2019-20. The reaction of the cultures against important pest and disease was also screened and as per the standard procedures the grain qualities were analyzed. The pedigree flow chart of finger millet variety Central Finger Millet Variety (CFMV-2/ Gira) is given in **Fig. 1**.

RESULTS AND DISCUSSION

The state trial data of the culture 'WN-559' along with local and national checks under three different locations in Gujarat viz; Hill Millet Research Station, Navsari Agricultural University, Waghai, Dangs; Agricultural Research Station, NAU, Vanarasi and Agricultural Research Station, AAU, Dahod are presented in **Table 1**. The WN-559 was tested in station trials from 2014-15 to 2019-20. This finger millet variety produced an average grain yield of 3551 kg/ha which is 15.02 per cent higher over local check GNN-6 as well as 27.47 and 25.88 per cent over national checks PR 202 and GPU 67, respectively.

Pure line Selection from germplasm 'WN-559' in 2010 from Dangs district

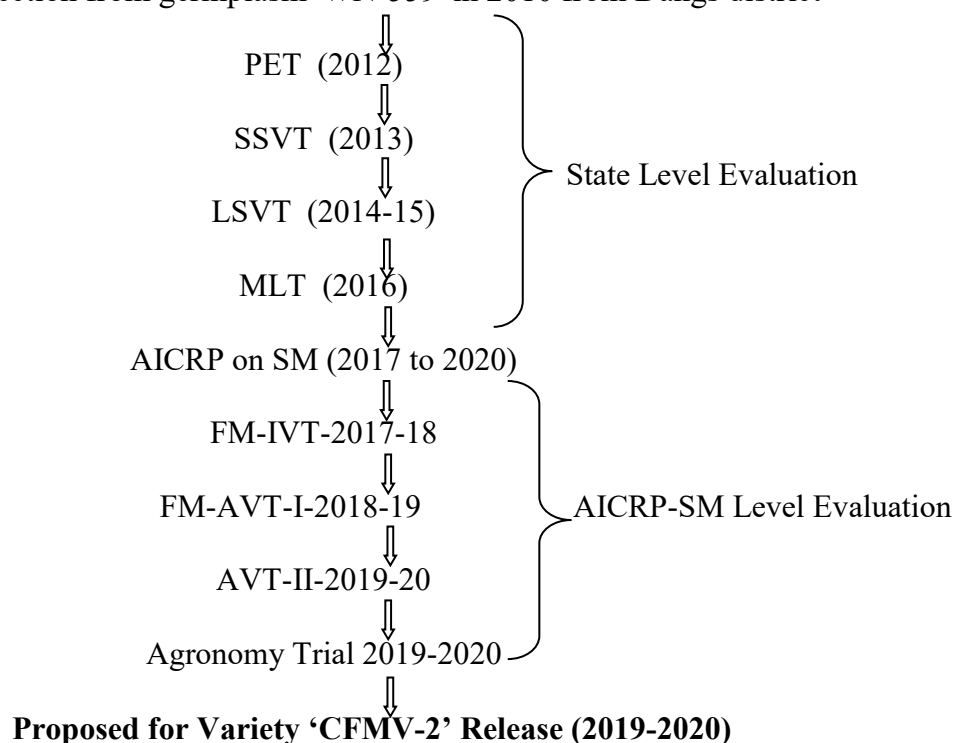


Fig. 1. Pedigree chart of Finger millet Culture 'FMV 1118' (WN-559)

Table 1. Performance of finger millet culture 'WN-559' for grain yield in comparison with check varieties in twelve trials under Gujarat state

Year	Name of the experiment	Location	Proposed Entry WN 559 Grain yield (kg/ha)	Check varieties Grain yield (kg/ha)			S.Em±	CD at 5%	CV %
				GNN 6(LC)	PR 202(NC)	GPU 67(NC)			
Kh-2014	SSVT	WAG	4416 ^{bc}	3987	2618	3360	175	514	7.9
		% increase over		10.76	68.68	31.43			
Kh-2015	SSVT	WAG	3833 ^{ab}	3177	2950	3329	195	567	11.1
		% increase over		20.65	29.93	15.14			
Kh-2016	LSVT	WAG	3282 ^{bc}	2938	2627	2802	137	399	8.1
		% increase over		11.71	24.93	17.13			
Kh-2017	LSVT	WAG	4797 ^{bc}	4753	3735	3695	173	502	7.3
		% increase over		0.93	28.43	29.82			
Kh-2018	LSVT	WAG	4624 ^{bc}	4155	3827	3714	232	681	7.4
		% increase over		11.29	20.83	24.50			
Kh-2019	LSVT	WAG	3340	2855	2833	2964	188	550	11.2
		% increase over		16.99	17.90	12.69			
Kh-2019	LSVT/ MLT	WAG	3431 ^a	2822	3019	2649	200	586	12.3
		Vanarasi	2955 ^{ab}	2324	2147	2119	157	462	11.8
		Dahod	2675 ^{abc}	2281	1958	2243	127	374	9.2
		Mean	3020	2476	2375	2337			
		% increase over		22.00	27.19	29.24			
Kh-2020	LSVT/ MLT	WAG	3322	2966	2960	2980	240	712	13.9
		Vanarasi	2980	2450	2507	2680	182	540	12.2
		Dahod	2960 ^{abc}	2341	2250	2346	151	444	9.71
		Mean	3088	2586	2573	2669			
		% increase over		19.41	19.99	15.70			
Over all mean (2014-2020)			3551	3087	2786	2821			
Over all % increase over checks				15.02	27.47	25.88			
Frequency in top non-significant group			9/12	6/12	4/12	4/12			

Note: ^a significantly superior over GNN-6 (LC), ^b significantly superior over PR-202 (NC), ^c significantly superior over GPU 67(NC)

At the national level, FMV-1118 yields on an average of 2950 kg/ha of grain yield which was 20.7, 32.6, 6.70, 7.70 and 17.4 per cent higher than national checks GPU-45, VL-352, GPU-67, PR-202 and VL-376, respectively in ICAR, All India Coordinated trials conducted at Andhra Pradesh, Chhattisgarh, Gujarat, Maharashtra and Odisha (Table 2a & 2b). Also, the proposed variety FMV-1118 yielded 8588 kg/ha of dry fodder yield with 12.3, 38.8, 11.11, 9.10 and 29.6 per cent increased yield over national checks GPU-45, VL-352, GPU-67, PR-202 and VL-376, respectively in All India Coordinated trials conducted at Andhra Pradesh, Chhattisgarh, Gujarat, Maharashtra and Odisha (Table 3a & 3b).

The 'CFMV-2' topped the list at the state level as well as national level, provided with significantly higher grain as well as fodder yield compared to the checks under *kharif* sown situations at Andhra Pradesh, Chhattisgarh,

Gujarat, Maharashtra and Odisha. Sood *et al.* (2016) in the identification of white finger millet genotypes, Kant *et al.* (2020) in wheat, Nandini *et al.* (2021) in the release of proso millet variety PMV 442, Intwala *et al.* (2017) in the release of finger millet variety 'GNN-6' and Patil *et al.* (2017) in the release of little millet variety 'GNV-3' also reported significant yield improvement in the new varieties as compared to pre-existing ones.

The proposed entry FMV-1118 evaluated for fertilizer response at Andhra Pradesh, Chhattisgarh, Gujarat, Maharashtra and Odisha under the AICRP-SM network to recommended dose *ie.* 100% RDF produces 2993 kg/ha of grain yield and 8000 kg/ha fodder yield while, applying of 125% RDF gives 3034 kg/ha grain and 8026 kg/ha fodder yield which indicates the net per cent gain of grain yield is 1.35 and 0.32 per cent for fodder yield (Table 4). As per farmers / consumer's preference showed better

Table 2 a. Grain yield (kg/ha) data of All India Coordinated Varietal Trials

Parameters	Year of testing	Number of trials / locations	Proposed variety FMV-1118 (WN-559)	National check varieties				
				GPU-45	VL-352	GPU-67	PR-202	VL-376
Mean Grain yield (kg/ha)	2017-18	8	2907	2530	2116	2953	2735	--
	2018-19	10	3054	2482	2335	2831	2926	--
	2019-20	10	2890	2320	--	2510	2552	2513
	Mean	28 (Total)	2950	2444	2225	2765	2738	2513
Percentage increase over the checks (2017-2020)				20.7	32.6	6.70	7.70	17.4
Over all mean (28)			2953	2454	--	2751	2738	--
Over all mean (18)			2981	--	2226	--	--	--
Over all mean (10)			2890	--	--	--	--	2513
Percentage increase over the check				20.3	33.9	7.30	7.90	15.0
Frequency in the top non significant group			11/28	1/28	0/28	17/28	20/28	7/28

Table 2 b. Centre wise data of grain yield (kg/ha) for 2017-18 to 2019-2020 in AICRP trial

State	Centre	Year of testing	Proposed variety FMV-1118 (WN-559)	National check varieties					C.D. @ 5 %	CV (%)
				GPU-45	VL-352	GPU-67	PR-202	VL-376		
Andhra Pradesh	Peddapuram	2017-18	2881	2600	1911	3304	3185	--	501	12.0
		2018-19	2778	2407	2596	3911	3030	--	479	9.4
		2019-20	3415 ^{ade}	3159	--	2622	3385	3356	718	13.0
		Mean	3025	2722	2254	3279	3200	3356	--	--
	Perumallapalle	2017-18	3287	3413	3049	3631	3743	--	280	6.7
		2018-19	5423	4411	2943	4901	5767	--	382	4.7
		2019-20	2712	3148	--	2712	3413	2890	1461	19.0
		Mean	3807	3657	2996	3748	4308	2890	--	--
	Vizianagaram	2017-18	3254	2983	2427	2639	3393	--	837	17.3
		2018-19	2890	2540	2262	3029	2784	--	689	15.0
		2019-20	3845*	2981	--	3302	3226	2455	500	9.0
		Mean	3330	2835	2345	2990	3134	2455	--	--
	Chintamalli	2019-20	3026	2911	--	3021	3080	2927	1188	13.0
	State Mean		3351	3055	2531	3307	3501	2907	--	--
Chhattisgarh	Jagdalpur	2017-18	1926	1506	1037	2198	1704	--	459	18.6
		2018-19	2685	3056	2469	2994	2593	--	416	9.0
		2019-20	3416 ^c	2416	--	2986	2819	2738	507	10.5
		Mean	2676	2326	1753	2726	2372	2738	--	--
	Dahod	2017-18	3747*	2895	2549	3179	2309	--	371	9.1
		2018-19	4306*	2968	3264	3481	3225	--	518	9.3
		2019-20	3670 ^e	2275	--	2451	2448	3336	842	18.6
		Mean	3908	2713	2907	3037	2661	3336		
Gujarat	Waghai	2017-18	3545	2811	2315	3776	3657	--	643	12.2
		2018-19	5111 ^c	3758	4079	4573	4059	--	640	8.8
		2019-20	4372 ^{cde}	2513	--	3571	3310	3261	1146	16.5
		Mean	4343	3027	3197	3973	3675	3261		
	State Mean		4125	2870	3052	3505	3168	3299	--	--

Table 2 b. Continued..

State	Centre	Year of testing	Proposed variety FMV-1118 (WN-559)	National check varieties					C.D. @ 5 %	CV (%)
				GPU-45	VL-352	GPU-67	PR-202	VL-376		
Maharashtra	Kolhapur	2017-18	3333 ^c	2216	2426	2858	1944	--	527	13.4
		2018-19	2364 ^d	1006	1148	1377	2253	--	448	17.8
		2019-20	2104	1998	--	2390	1721	2446	571	16.2
		Mean	2600	1740	1787	2208	1973	2446		
	Dapoli	2018-19	1339	1694	756	822	1550	--	58	2.9
		2019-20	448	471	--	448	460	454	100	13.1
		Mean	894	1083	756	635	1005	454		
	Igatpuri	2018-19	1809	1809	2111	1407	1802	--	317	10.9
	State Mean		1900	1532	1610	1550	1622	1450	--	--
	Odisha	Behrampur	2017-18	1279	1817	1210	2040	1946	--	533
2018-19			1832	1170	1719	1817	2198	--	253	9.1
2019-20			1896 ^{cd}	1323	--	1595	1659	1269	406	16.2
Mean			1669	1437	1465	1817	1934	1269	--	--
Overall mean			2953	2454	2237	2751	2738	2513	--	--
Percentage increase over the checks				20.3	32.0	7.3	7.9	17.5	--	--

Note: ^a Significantly superior over GPU-45 (NC), ^b Significantly superior over VL-352 (NC)

^c Significantly superior over GPU 67 (NC), ^d Significantly superior over PR 202 (NC)

^e Significantly superior over VL 376 (NC) & * Highly significant for all checks.

Table 3 a. Dry Fodder yield (kg/ha) data of All India Coordinated Varietal trials

Parameters	Year of testing	Number of trials / locations	Proposed variety FMV-1118 (WN-559)	National check varieties				
				GPU-45	VL-352	GPU-67	PR-202	VL-376
Mean dry fodder yield (q/ha)	2017-18	7	8785	8081	6202	8546	7872	--
	2018-19	9	8863	7995	6171	7884	8329	--
	2019-20	7	8118	6859	--	6753	7425	6626
	Mean	23 (Total)	8588	7645	6187	7727	7875	6626
Percentage increase over the checks (23 locations)				12.3	38.8	11.11	9.10	29.6
Over all mean (23)			8589	7645	--	7727	7875	--
Over all mean (16)			8491	--	6171	--	--	--
Over all mean (7)			8118	--	--	--	--	6626
Percentage increase over the checks			--	12.3	37.6	11.11	9.10	22.5

acceptability than the check variety due to its good grain size, semi open panicle and better grain yield.

The proposed entry FMV-1118 is moderately resistant to leaf blast (%), foot rot (%), brown spot (G), grain mould (G), neck blast (%), finger blast (%) and banded blight (PDI) (Table 5 and 6) and tolerant to stem borer (%) while moderately resistance to plants and panicles affected by shoot aphid (%), myllocerus weevil, grasshopper affected leaves/ leaf area (%) at Andhra Pradesh, Chhattisgarh,

Gujarat, Maharashtra and Odisha at state as well as national level screening under AICRP-Small millets (Table 7 and 8).

The CFMV-2 (WN 559/ FMV-1118) is rich in calcium (454 mg/100 g), iron (39 ppm), zinc (25 ppm) in comparison with 200 mg/ 100 g calcium, 25 ppm iron, 16 ppm zinc, respectively in popular released varieties (Patil *et al.*, 2019), also found with mineral matter 4.42 g/100 g with good protein as well as crude fiber content as compared

Table 3 b. Centre wise data of fodder yield (kg/ha) for 2017-18 to 2019-2020

State	Centre	Year of testing	Proposed variety FMV-1118 (WN-559)	National check varieties				
				GPU-45	VL-352	GPU-67	PR-202	VL-376
Andhra Pradesh	Peddapuram	2017-18	7607	6481	5748	8556	6689	--
		2018-19	10707	11115	4593	11856	12174	--
		Mean	9157	8798	5171	10206	9432	--
	Perumallapalle	2017-18	13267	12639	6091	12877	13909	--
		2018-19	18829	17798	16706	16766	18677	--
		2019-20	6217	8915	--	5979	9365	6958
		Mean	12771	13117	11399	11874	13984	6958
	Vizianagaram	2017-18	8340	8697	7956	7249	6091	--
		2018-19	7917	8665	5979	7672	7877	--
		2019-20	7738	6925	--	7302	7090	6343
		Mean	7998	8096	6968	7408	7019	6343
	State Mean		10078	10154	7846	9782	10234	6651
Chhattisgarh	Jagdalpur	2017-18	6519	7012	4346	7605	6716	--
		2018-19	8704	10005	6790	8889	9630	--
		2019-20	8820	7392	--	8550	9048	7153
		Mean	8014	8135	5568	8348	8465	7153
	Dahod	2017-18	10000	7407	6790	8333	6852	--
2018-19		10864	8889	8395	10123	9383	--	
2019-20		10818	8142	--	7354	8674	9951	
Mean		10561	8146	7593	8603	8303	9951	
Gujarat	Waghai	2017-18	10317	9041	9431	10126	9630	--
		2018-19	13353	8681	7210	8973	8128	--
		2019-20	15714	11025	--	11356	10820	10714
		Mean	13128	9582	8321	10152	9526	10714
	State Mean		11844	8864	7957	9378	8915	10333
Maharashtra	Kolhapur	2018-19	2716	1185	1315	1580	2593	--
		2018-19	3167	3256	1817	1889	3417	--
	Dapoli	2019-20	1075	1143	--	999	1102	1090
		Mean	2121	2200	1817	1444	2260	1090
		State Mean		2319	1861	1566	1489	2371
Odisha	Berhampur	2017-18	5442	5289	3052	50.77	5215	--
		2018-19	3506	2370	2736	32.05	3081	--
		2019-20	6444	4469	--	57.28	5877	4173
		Mean	5131	4043	2894	46.70	4724	4173
	Over all mean		8588	7645	6187	7727	7875	6626
Percentage increase over the national checks				12.30	38.8	11.11	9.10	29.6

with all the checks which showed the high nutritional value of biofortified variety (Table 9). Chetan and Malleshi (2007) showed better grain quality superiority in released varieties as compared to local check varieties. Similarly, Patil *et al.* (2017) also reported superior nutritional quality in little millet variety GNV-3.

The variety CFMV-2 matures in 120-125 days. It has an erect plant habit with 110 cm plant height. The plant type is non-lodging with profuse tillering ability, with non shattering panicle type. The panicle is semi open with the main ear head length 8 to 9 cm. The bold grain size with 1000 seed weight is 2.94 g. The grain is an attractive

Table 4. Adaptability to Agronomic Variables: Response of variety to different levels of Fertilizer

Name of experiment	Parameters	Fertilizer dose	Location	Proposed variety						National check varieties						Qualifying variety																	
				FMV-1118 (WN-559)						PR-202						FMV-1114 (WN-585)						FMV-1116 (VR 1101)						FMV-1117 (PR 1511)					
				Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield										
Fertilizer experiment	F ₂ = 100 % RDF	Jagadapur	2546	6548	1931	4782	2381	6746	2057	5109	2345	6448	2679	7440																			
		Peddapuram	3229	6059	2500	4757	3056	5747	2639	4861	3194	5938	2882	5278																			
		Vizianagaram	2969	9167	2552	8351	2743	8594	2535	8194	3090	9288	2622	9462																			
		Waghai	3229	1022	1962	6823	2795	7066	2413	4965	2431	6910	2639	8559																			
		Mean	2993	8000	2236	6178	2744	7038	2411	5782	2765	7146	2705	7685																			
	F ₀ = Absolute Control	Jagadapur	2050	5377	1445	4167	1868	5060	1786	3968	1687	4365	2116	5456																			
		Peddapuram	2552	5087	1823	3802	2378	4757	1962	3889	2517	4965	2205	4010																			
		Vizianagaram	1007	5104	764	4149	781	4271	799	4288	1285	5660	990	5885																			
		Waghai	2240	7170	1771	4462	1840	5469	2031	4063	1736	4844	1840	6545																			
		Mean	1962	5685	1451	4145	1717	4889	1644	4052	1806	4958	1788	5474																			
Fertilizer experiment	% Loss	Jagadapur	24.20	21.78	33.63	14.76	27.46	33.32	15.17	28.76	39.00	47.72	26.61	36.36																			
		Peddapuram	26.53	19.11	37.14	25.12	28.51	20.81	34.51	24.99	26.90	19.60	30.70	31.62																			
		Vizianagaram	194.84	79.60	234.0	101.28	251.22	101.22	217.27	91.09	140.47	64.10	164.85	60.78																			
		Waghai	44.15	42.62	10.78	52.91	51.90	29.20	18.81	22.20	40.03	42.65	43.42	30.77																			
		Mean	52.55	40.72	54.10	49.05	59.81	43.96	46.65	42.69	53.10	44.13	51.29	40.39																			
	F ₁ = 75 % RDF	Jagadapur	1935	5506	1786	5265	2083	5208	1951	4911	2080	5407	2050	5655																			
		Peddapuram	2917	5469	2222	4236	2778	5208	2326	4340	2899	5417	2587	4444																			
		Vizianagaram	2656	8524	2101	7326	2292	7535	2257	7674	2674	8403	2292	8490																			
		Waghai	2969	8194	1806	5313	2222	6788	2066	4549	2205	4844	2309	7326																			
		Mean	2619	6923	1979	5535	2344	6185	2150	5368	2464	6017	2309	6479																			
Fertilizer experiment	% Loss	Jagadapur	31.58	18.92	8.12	-9.17	14.31	29.53	5.43	4.03	12.74	19.25	30.68	31.56																			
		Peddapuram	10.70	10.79	12.51	12.30	10.01	10.35	13.46	12.00	10.18	9.62	11.40	18.77																			
		Vizianagaram	11.78	7.54	21.47	13.99	19.68	14.05	12.32	6.78	15.56	10.53	14.40	11.45																			
		Waghai	8.76	24.80	8.64	28.42	25.79	4.10	16.80	9.14	10.25	42.65	14.29	16.83																			
		Mean	14.28	15.56	12.99	11.62	17.06	13.79	12.14	7.71	12.22	18.76	17.15	18.61																			
	F ₃ = 125 % RDF	Jagadapur	2067	5506	2116	5823	1951	5169	1736	4514	1925	5060	2159	6498																			
		Peddapuram	3420	6337	2708	4931	3264	5903	2830	5017	3403	6215	3073	5451																			
		Vizianagaram	3368	1001	2934	9167	3073	9184	2726	8750	3524	1005	3125	1017																			
		Waghai	3281	1024	2066	9479	3212	7361	2622	5017	2604	7517	2795	8854																			
		Mean	3034	8026	2456	7350	2875	6904	2478	5825	2864	7211	2788	7744																			
Fertilizer experiment	% Gain	Jagadapur	-23.17	-18.92	8.74	17.88	-22.04	-30.51	-18.49	-13.18	-21.82	-27.43	-24.09	-14.50																			
		Peddapuram	5.58	4.39	7.68	3.53	6.37	2.64	6.75	3.11	6.14	4.46	6.22	3.17																			
		Vizianagaram	11.85	8.49	13.02	8.90	10.74	6.42	7.01	6.35	12.32	7.60	16.10	7.00																			
		Waghai	1.58	0.17	5.03	28.02	12.98	4.01	7.97	1.04	6.64	8.08	5.58	3.33																			
		Mean	1.35	0.32	8.96	15.95	4.56	-1.94	2.70	0.74	3.46	0.90	2.98	0.76																			

Table 5. Reaction to major diseases in AICRP-SM trial

Parameters	Year of testing	Number of trials / locations	Proposed variety FMV-1118 (WN-559)	National check varieties					Qualifying variety		
				GPU-45	VL-352	GPU-67	PR-202	VL-376	FMV-1114 (WN-585)	FMV-1116 (VR 1101)	FMV-1117 (PR 1511)
Leaf blast (%) (<i>Pyricularia grisea</i>)	2017-18	8	4.22	3.39	3.03	5.17	4.39	--	2.89	4.11	4.61
	2018-19	5	2.87	3.00	2.47	3.40	3.27	--	2.53	2.92	2.53
	2019-20	5	3.64	2.51	--	2.81	3.27	2.72	2.08	3.13	3.56
	Mean	6	3.58	2.97	2.75	3.79	3.64	2.72	2.50	3.39	3.57
Neck blast (%) (<i>Pyricularia grisea</i>)	2017-18	7	38.41	61.30	56.02	43.79	49.68	--	55.23	49.64	35.03
	2018-19	5	17.68	16.44	15.93	26.71	22.94	--	15.82	10.25	20.34
	2019-20	5	16.64	19.93	--	13.41	25.96	23.41	14.38	19.30	20.83
	Mean	6	24.24	32.56	35.98	27.97	32.86	23.41	28.48	26.40	25.40
Finger blast (%) (<i>Pyricularia grisea</i>)	2017-18	8	28.68	35.63	44.91	20.85	35.18	--	42.18	34.62	31.41
	2018-19	5	16.66	17.78	14.57	19.86	18.89	--	16.96	9.53	18.98
	2019-20	5	15.95	16.12	--	10.10	21.27	18.14	16.08	17.50	18.28
	Mean	6	20.43	23.18	29.74	16.94	25.11	18.14	25.07	20.55	22.89
Banded blight (PDI) (<i>Rhizoctonia solani</i>)	2017-18	3	23.20	13.90	39.37	30.20	24.73	--	34.60	27.63	26.13
	2018-19	2	45.33	45.36	45.21	46.05	46.90	--	45.61	14.03	46.35
	2019-20	2	61.53	45.22	--	55.08	43.478	58.28	53.58	46.87	59.73
	Mean	2	43.35	34.83	42.29	43.78	38.37	58.28	44.60	29.51	44.07
Foot rot (%) (<i>Sclerotium rolfsii</i>)	2017-18	2	6.13	6.23	6.20	17.24	5.05	--	7.25	4.72	4.57
	2018-19	1	7.14	6.01	14.51	5.77	4.88	--	8.97	5.64	10.60
	2019-20	1	3.36	9.60	--	16.16	10.00	11.62	4.55	4.90	12.12
	Mean	1	5.54	7.28	10.36	13.06	6.64	11.62	6.92	5.09	9.10
Brown spot (G) (<i>C. eleusinis</i>)	2017-18	4	3.50	4.83	4.67	4.83	5.33	--	3.50	5.67	4.50
	2018-19	1	2.50	1.57	2.00	2.50	1.00	--	1.50	1.50	1.00
	2019-20	3	2.56	3.17	--	2.78	3.11	3.11	2.89	3.22	3.06
	Mean	3	2.85	3.19	3.34	3.37	3.15	3.11	2.63	3.46	2.85
Grain mould (G) (<i>Fusarium spp.</i>)	2017-18	1	11.00	9.76	1.63	20.52	23.48	--	4.69	15.00	11.35
	2018-19	1	4.13	4.73	9.22	0.00	5.08	--	2.13	5.50	9.18
	2019-20	1	8.48	3.69	--	4.78	12.10	6.30	3.92	5.08	4.13
	Mean	1	7.87	6.06	5.43	8.43	13.55	6.30	3.58	8.53	8.22

Table 6. Reaction to major diseases of finger millet at Waghai location

S. No.	Name of entry	Reaction to Blast disease (%)												Reaction to foot rot (%)			
		Leaf blast				Neck blast				Finger blast				2018	2019	2020	DR
		2018	2019	2020	DR	2018	2019	2020	DR	2018	2019	2020	DR				
1.	WN- 559	11.44	10.89	11.44	MR	14.38	12.38	14.05	MR	11.84	11.89	10.00	MR	11.25	9.00	11.25	MR
2.	GNN- 6 (LC)	14.13	12.12	14.01	MR	15.12	14.18	18.40	MR	17.15	15.15	13.80	MR	13.50	11.25	9.00	MR
3.	GPU-67 (NC)	19.78	16.67	10.00	MR	9.76	8.81	7.38	MR	15.25	13.80	13.83	MR	11.25	13.50	11.25	MR

Table 7. Reaction to major pests in AICRP-SM trial

Parameters	Year of testing	Number of trials / locations	Proposed variety FMV-1118 (WN-559)	Check varieties					Qualifying variety		
				GPU-45	VL-352	GPU-67	PR-202	VL-376	FMV-1114 (WN-585)	FMV-1116 (VR 1101)	FMV-1117 (PR 1511)
Grasshopper	2018-19	1	20.03	16.08	15.97	14.40	16.78	--	18.62	19.02	16.99
Affected leaves/ leaf area (%)	2019-20	1	61.27	34.92	--	20.96	24.07	40.21	12.76	30.55	28.79
	Mean	1	40.65	25.50	15.97	17.68	20.43	40.21	15.69	24.79	22.89
Stem borer (%)	2018-19	1	0.00	0.00	0.00	3.33	1.11	--	1.11	0.00	0.00
	Score		1	1	1	1	1	1	1	1	1
Plants affected by shoot aphid (%)	2018-19	1	8.64	9.91	9.77	10.14	9.34	--	7.86	8.15	8.10
	2019-20	1	9.77	8.10	--	8.15	8.64	7.22	9.67	9.11	10.03
	Mean	1	9.21	9.01	9.77	9.15	8.99	7.22	8.77	8.63	9.07
	Score		1	1	1	1	1	1	1	1	1
Panicles affected by Shoot aphid (%)	2018-19	1	6.88	10.48	9.93	10.04	9.37	--	6.62	6.04	6.44
	2019-20	1	8.40	6.44	--	6.04	6.88	7.62	9.30	9.54	7.94
	Mean	1	7.64	8.46	9.93	8.04	8.13	7.62	7.96	7.79	7.19
	2019-20	2	4.67	3.34	--	5.00	3.67	3.67	5.00	1.34	3.17
	Mean	1	3.84	2.67	1.67	3.67	3.17	3.67	3.17	2.34	2.59
	Score		1	1	1	1	1	1	1	1	1

Table 8. Reaction to major pest at Waghai location

S. No.	Name of entry	Aphids index (1-5)			Hairy caterpillar/plot			Dead hearts %		
		2018	2019	2020	2018	2019	2020	2018	2019	2020
1.	WN- 559	1.22	1.40	1.33	1	2	1	7.50	14.64	8.52
2.	GNN- 6 (LC)	1.50	1.20	1.26	2	2	2	10.60	18.90	10.52
3.	GPU-67 (NC)	1.60	1.85	1.70	4	3	5	10.55	22.30	11.45

Table 9. Data of WN-559 on nutritional quality and sensory evaluation characteristics in AICRP-SM trial

S. No	Quality characteristics	Proposed variety WN-559	Local variety GNN-6	National check VL-376	National check PR-202
Parameters					
a)	Nutritional quality:				
1.	Protein (g/100g)	6.41	6.75	6.01	6.55
2.	Carbohydrate (g /100g)	70.10	72.50	68.40	75.20
3.	Crude fiber (%)	3.64	3.30	3.44	3.28
4.	Crude fat (%)	1.32	1.31	1.40	1.33
5.	Mineral matter (g/100g)	4.42	3.60	3.46	4.10
6.	Calcium (mg/100g)	454	412	440	429
7.	Iron (ppm)	39	25	33	34
8.	Zn content (ppm)	25	16	21	20
b)	Sensory evaluation score (1-10 score)				
1.	Colour & appearance	10.0	9.0	8.0	9.0
2.	Flavour	9.5	9.0	9.5	9.5
3.	Texture	10.0	8.5	8.0	9.0
4.	Taste	9.5	9.0	8.5	9.0
5.	Grain Shape	Oval	Oval	Oval	Oval
6.	Grain Size	Bold	Bold	Bold	Bold



MATURED EAR HEAD



FIELD VIEW



EAR HEAD



GRAINS

PLATE 1. Morphological traits of CFMV 2

Table 10. Data of CFMV-2 (WN-559) on important morphological characters

S. No.	Morphological characters	WN 559 (GIRA)	GNN 6 (LC)	GPU 67 (NC)
1.	Plant height (cm)	: 110	95	100
2.	Mean days to 50% flowering	: 88	96	89
3.	Mean days to maturity	: 120	135	122
4.	Mean ear head length (cm)	: 8.5	7.08	7.03
5.	Number of fingers / earhead	: 7.0	5.0	6.0
6.	Mean productive tillers/ plant	: 3.5	3.0	3.3
7.	1000 grain weight (g)	: 2.94	2.60	2.74
8.	Mean grain yield (kg/ha)	: 2993	2675	2710
9.	Mean dry fodder yield (kg/ha)	: 8588	7655	7741
10.	Maturity (seed to seed) (range in number of days)	: 115-125	130-140	120-130
11.	Maturity group	: Medium	Late	Medium
12.	Ear head habit	: Semi Open	Compact	Semi Open
13.	Plant type	: Erect	Erect	Erect
14.	Foliage	: Green	Green	Light Green
15.	Lodging/ Non- lodging	: Non-Lodging	Non-Lodging	Non-Lodging
16.	Grain colour	: Reddish Brown	Reddish Brown	Reddish Brown
17.	Shattering pattern	: Non-Shattering	Non-Shattering	Non-Shattering

reddish colour. Descriptive morphological/botanical characters with checks are given in **Table 10** and **Plate 1**. Considering the superior performance of this variety, it was accepted by the National Varietal Identification Committee Meeting (Virtual mode) held on 23rd May 2020 by ICAR-Indian Institute of Millets research, Hyderabad held during ICAR AICRP-Sorghum and Small Millets Annual Workshop, 2020. Also, accepted in 17th Annual AGRESO Subcommittee Crop Improvement (Annon. 2019) and Annual Joint AGRESO meeting held at NAU, Navsari during March 2021 as well as recommended in 17th Combined Joint AGRESO meeting of SAUs to be held at SDAU, Sardarkrushinagar during 27th to 29th April 2021. CFMV-2 (Gira) has been notified with No. 456/500/2021 (SO 224901E).

Hence, finger millet biofortified variety CFMV-2 (Gira) is recommended for finger millet growing regions of Andhra Pradesh, Chhattisgarh, Gujarat, Maharashtra and Odisha due to its high grain yield as well as fodder yield with attractive red colored bold grain, uniform maturity and having non-lodging plant type, moderately resistant to foot rot, leaf, neck and finger blast diseases and moderate resistance to pests like stem borer and aphids under rainfed condition.

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