Seed priming with gas plasma-activated water in Ethiopia's "orphan" crop tef (*Eragrostis tef*)

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Supplementary Table S1 Time taken for germination to reach 50% of germination (T50%) and ANOVA followed by post-hoc tests of T50% for data represented in Fig. 3. T(50%) is given as the average of the 3 biological replicates (each containing 50 grains) ± standard deviation. White commercial tef has been untreated (control), hydroprimed or GPAW primed and germinated under 12,16,20 and 32°C. *P* values from Tukey's multiple comparisons test are presented as ****, $P < 0.0001$; ***, $P = 0.0001$ to 0.001; **, $P = 0.001$ to 0.01; *, $P = 0.01$ to 0.05; ns (not significant), $P > 0.05$

Time to reach T(50%) in days	Control	Hydroprimed	GPAW primed
12°C	2.68 ± 0.12	2.59 ± 0.12	2.03 ± 0.20
16°C	1.54 ± 0.18	1.1 ± 0.10	1.16 ± 0.17
20°C	0.96 ± 0.06	0.88 ± 0.03	0.82 ± 0.01
32°C	0.65 ± 0.07	0.6 ± 0.05	0.51 ± 0.13

12°C	Control	Hydroprimed	GPAW primed
Hydroprimed	ns		
GPAW primed	****	***	

16°C	Control	Hydroprimed	GPAW primed
Hydroprimed	**		
GPAW primed	*	ns	

20°C	Control	Hydroprimed	GPAW primed
Hydroprimed	ns		
GPAW primed	ns	ns	

32°C	Control	Hydroprimed	GPAW primed
Hydroprimed	ns		
GPAW primed	ns	ns	

Supplementary Table S2 Maximum % of germination (G_{max}) and ANOVA followed by post-hoc tests of G_{max} for data presented in Fig. 4 (white grains). G_{max} is given as the average of the 3 biological replicates (each containing 50 grains) ± standard deviation. White commercial tef has been untreated (control), hydroprimed or GPAW primed and aged for 3 days or 7 days under 80% RH. *P* values from Tukey's multiple comparisons test are presented as ****, $P < 0.0001$; ***, $P = 0.0001$ to 0.001; **, $P = 0.001$ to 0.01; *, $P = 0.01$ to 0.05; ns (not significant), $P > 0.05$

G_{max} [%]	**Control**			**Hydroprimed**			**GPAW primed**		
White		**80% RH**			**80% RH**			**80% RH**	
	C	**3d**	**7d**	**C**	**3d**	**7d**	**C**	**3d**	**7d**
12°C	86,9 ± 7.7	71.6 ± 7.8	47.4 ± 11.3	81.7 ± 4.2	63.3 ± 2.5	15.4 ± 5.3	81.7 ± 8.8	72.6 ± 7.3	47.9 ± 14.7
20°C	97.4 ± 1.1	98.1 ± 0.4	84.2 ± 5.7	97.5 ± 0.8	68.4 ± 2.4	31.8 ± 1.9	97.6 ± 2.3	96.6 ± 2.6	93.5 ± 5.0

12°C White	Control	Control 80% 3d aged	Control 80% 7d aged	Hydro primed	Hydro primed 80% 3d aged	Hydro primed 80% 7d aged	GPAW	GPAW primed 80% 3d aged
Control 80% 3d	ns							
Control 80% 7d	***	ns						
Hydro primed	ns	ns	**					
Hydro primed 80% 3d	ns	ns	ns	ns				
Hydro primed 80% 7d	****	****	**	****	****			
GPAW	ns	ns	**	ns	ns	****		
GPAW primed 80% 3d	ns	ns	*	ns	ns	****	ns	
GPAW primed 80% 7d	***	ns	ns	**	ns	**	**	*

20°C White	Control	Control 80% 3d aged	Control 80% 7d aged	Hydro primed	Hydro primed 80% 3d aged	Hydro primed 80% 7d aged	GPAW	GPAW primed 80% 3d aged
Control 80% 3d	ns							
Control 80% 7d	*	ns						
Hydro primed	ns	ns	ns					
Hydro primed 80% 3d	ns	ns	ns	ns				
Hydro primed 80% 7d	**	*	ns	**	*			
GPAW	ns	ns	ns	ns	ns	*		
GPAW primed 80% 3d	ns	ns	ns	ns	ns	*	ns	
GPAW primed 80% 7d	*	ns	ns	*	ns	ns	ns	ns

Supplementary Table S3 Maximum % of germination (G_{max}) and ANOVA followed by post-hoc tests of G_{max} for data presented in Fig. 4 (brown grains). G_{max} is given as the average of the 3 biological replicates (each containing 50 grains) ± standard deviation. Brown commercial tef has been untreated (control), hydroprimed or GPAW primed and aged for 3 days or 7 days under 80% RH. *P* values from Tukey's multiple comparisons test are presented as ****, $P < 0.0001$; ***, $P = 0.0001$ to 0.001; **, $P = 0.001$ to 0.01; *, $P = 0.01$ to 0.05; ns (not significant), $P > 0.05$

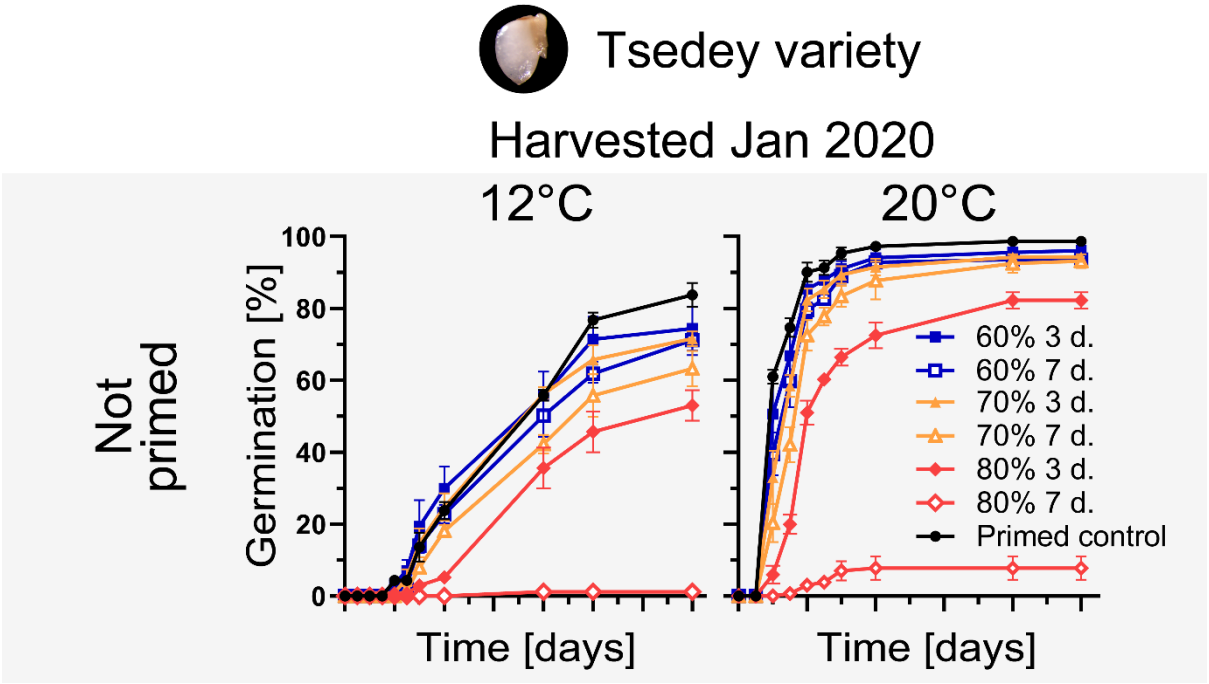
G_{max} [%]	**Control**			**Hydroprimed**			**GPAW primed**		
Brown		**80% RH**			**80% RH**			**80% RH**	
	C	**3d**	**7d**	**C**	**3d**	**7d**	**C**	**3d**	**7d**
12°C	95.3 ± 1.4	93.5 ± 1.6	79.0 ± 3.4	93.6 ± 3.5	52.0 ± 5.0	22.1 ± 2.5	92.9 ± 6.5	89.1 ± 3.6	78.9 ± 5.5
20°C	93.5 ± 1.7	89.0 ± 1.2	82.2 ± 4.9	91.7 ± 1.5	89.0 ± 1.2	78.4 ± 4.2	88.9 ± 1.5	90.5 ± 4.3	81.4 ± 6.7

12°C Brown	Control	Control 80% 3d aged	Control 80% 7d aged	Hydro primed	Hydro primed 80% 3d aged	Hydro primed 80% 7d aged	GPAW	GPAW primed 80% 3d aged
Control 80% 3d	ns							
Control 80% 7d	**	**						
Hydro primed	ns	ns	**					
Hydro primed 80% 3d	****	****	****	****				
Hydro primed 80% 7d	****	****	****	****	****			
GPAW	ns	ns	*	ns	****	****		
GPAW primed 80% 3d	ns	ns	ns	ns	****	****	ns	
GPAW primed 80% 7d	**	**	ns	**	****	****	**	ns

20°C Brown	Control	Control 80% 3d aged	Control 80% 7d aged	Hydro primed	Hydro primed 80% 3d aged	Hydro primed 80% 7d aged	GPAW	GPAW primed 80% 3d aged
Control 80% 3d	ns							
Control 80% 7d	**	***						
Hydro primed	ns	ns	**					
Hydro primed 80% 3d	****	****	***	****				
Hydro primed 80% 7d	****	****	****	****	****			
GPAW	ns	ns	***	ns	****	****		
GPAW primed 80% 3d	ns	ns	**	ns	****	****	ns	
GPAW primed 80% 7d	ns	ns	*	ns	****	****	ns	ns

Supplementary Table S4 Germination speed of all studied tef grain varieties. Average time [days] ± SE to reach 50% of germination for primed and untreated grains. Grains have been primed with hydropriming or GPAW priming at 20% MC for 15 h and aged at 70% RH for 3 and 7 days (0 days = unaged control). Shown are the values for three Tsedey batches (harvested January 2019, April 2019 and January 2020), a brown tef batch received from a Swiss farm and two commercial tef batches (Lovegrass Ltd, Kenly, UK, white batch no 20120, brown batch no 200707)

		Not primed			Hydroprimed			GPAW primed		
		0 d	3 d	7 d	0 d	3 d	7 d	0 d	3 d	7 d
Tsedey Jan 2019	12°C	2.0 ± 0.1	2.2 ± 0.1	3.5 ± 0.6	1.4 ± 0.1	1.7 ± 0.1	2.1 ± 0.1	1.4 ± 0.0	1.7 ± 0.1	2.0 ± 0.2
	20°C	0.4 ± 0.0	0.8 ± 0.0	1.0 ± 0.1	0.3 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	0.3 ± 0.0	0.8 ± 0.0	0.8 ± 0.0
Tsedey Apr 2019	12°C	4.1 ± 0.6	5.0 ± 0.7	8.5 ± 1.0	2.7 ± 0.2	4.5 ± 1.6	4.9 ± 0.3	3.6 ± 0.2	4.8 ± 0.5	6.4 ± 0.1
	20°C	1.4 ± 0.2	1.6 ± 0.1	1.8 ± 0.1	0.9 ± 0.0	1.1 ± 0.1	1.3 ± 0.1	1.0 ± 0.0	1.1 ± 0.1	1.2 ± 0.1
Tsedey Jan 2020	12°C	7.3 ± 0.2	7.2 ± 0.3	9.9 ± 1.3	4.3 ± 0.3	5.2 ± 0.1	5.7 ± 0.1	4.6 ± 0.5	5.2 ± 0.4	6.2 ± 0.2
	20°C	1.4 ± 0.2	1.6 ± 0.1	1.8 ± 0.1	0.9 ± 0.0	1.1 ± 0.1	1.3 ± 0.1	1.0 ± 0.0	1.1 ± 0.1	1.2 ± 0.1
Brown tef (Swiss farm)	12°C	0.9 ± 0.0	1.2 ± 0.1	1.7 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	1.1 ± 0.1	0.9 ± 0.0	0.9 ± 0.1	1.1 ± 0.1
	20°C	0.7 ± 0.0	0.7 ± 0.0	0.8 ± 0.0	0.7 ± 0.0	0.7 ± 0.0	0.7 ± 0.0	0.7 ± 0.0	0.7 ± 0.0	0.7 ± 0.0
Commercial white	12°C	1.7 ± 0.1	2.2 ± 0.1	2.7 ± 0.2	2.7 ± 0.2	3.2 ± 0.1	3.1 ± 0.1	2.8 ± 0.0	2.9 ± 0.0	3.4 ± 0.4
	20°C	0.8 ± 0.0	0.9 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	0.9 ± 0.1	1.0 ± 0.1	0.8 ± 0.0	0.9 ± 0.0	1.0 ± 0.0
Commercial brown	12°C	1.1 ± 0.1	1.4 ± 0.0	1.8 ± 0.2	1.9 ± 0.2	1.8 ± 0.1	1.8 ± 0.0	1.8 ± 0.0	1.9 ± 0.0	2.2 ± 0.2
	20°C	0.7 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	0.7 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	0.8 ± 0.0



Supplementary Fig. S1 Artificial ageing of untreated grains of the Tsedey variety harvested in January 2020. Black lines show the control, which are untreated seeds and coloured lines show seeds that were aged at 60%, 70% or 80% for 3 (filled markers) days or 7 days (empty markers), respectively. Seeds were germinated after the ageing treatment at either 12°C or 20°C. Mean values ±SE (n = 3)

Supplementary Table S5 Yield-related traits for white and brown tef grains (Lovegrass Ltd, Kenly, UK, white batch no 20120, brown batch no 200707) in field and pot experiments. Grains have been either untreated, hydroprimed (HP) or GPAW primed (GPP). Mean values ±SE (n = 2)

		Commercial tef (white)			**Commercial tef (brown)**		
		Control	**HP**	**GPP**	**Control**	**HP**	**GPP**
Pot	Fresh weight [mg] / 10 plants	14.1	12	14.5	12	12.9	12.3
	Dry weight [mg] / 10 plants	2.4	2.2	2.6	2.1	2.5	2.4
Field	Plant height [cm]	90.2 ± 7.4	96.6 ± 0.2	93 ± 8	91.2 ± 1.8	90.8 ± 4.6	103.3 ± 7.1
	Peduncle length [cm]	37.2 ± 4.4	41.7 ± 0.5	39.4 ± 4	38.3 ± 0.7	38.1 ± 3.9	43 ± 2.4
	Shoot biomass [g] /plot	360 ± 10	375 ± 25	350 ± 50	275 ± 25	300 ± 50	285 ± 35