Consolidated results of the simulation of grain fracture under impact cutting

№	α, °	l, mm	V, m/s	Grain destruction force F, N								
				Maize			Wheat			Barley		
				the vertical position	the lateral surface	the horizontal position	the vertical position	the lateral surface	the horizontal position	the vertical position	the lateral surface	the horizontal position
1	10	1	4.72	136	328	896	57	141	93	39	83	52
2	10	1	7.07	147	335	916	59	140	84	41	83	45
3	10	1	9.42	183	296	810	77	129	138	53	78	85
4	35	1	4.72	86	145	280	38	134	117	27	78	65
5	35	1	7.07	84	172	191	36	84	80	24	49	44
6	35	1	9.42	89	158	180	35	94	66	25	55	36
7	60	1	4.72	31	79	206	16	32	22	11	19	12
8	60	1	7.07	30	85	197	13	31	25	9	18	13
9	60	1	9.42	34	75	224	14	35	25	10	21	14
10	10	1.5	4.72	136	240	600	56	144	81	39	86	45
11	10	1.5	7.07	146	240	565	64	146	65	43	86	35
12	10	1.5	9.42	172	251	591	73	130	77	50	77	42
13	35	1.5	4.72	82	161	260	34	89	62	23	53	33
14	35	1.5	7.07	82	133	269	35	64	76	24	37	41
15	35	1.5	9.42	85	125	278	36	75	46	24	44	26
16	60	1.5	4.72	27	75	224	11	34	21	7	21	11
17	60	1.5	7.07	29	85	222	15	34	19	10	21	10
18	60	1.5	9.42	33	88	233	11	36	17	7	22	9
19	10	2	4.72	119	202	551	48	124	81	33	74	45

№	α, °	l, mm	V, m/s	Grain destruction force F, N								
				Maize			Wheat			Barley		
				the vertical position	the lateral surface	the horizontal position	the vertical position	the lateral surface	the horizontal position	the vertical position	the lateral surface	the horizontal position
20	10	2	7.07	138	193	529	62	90	69	42	55	38
21	10	2	9.42	177	212	581	71	101	65	49	60	36
22	35	2	4.72	89	136	159	38	84	58	27	50	32
23	35	2	7.07	78	129	180	33	78	74	23	46	40
24	35	2	9.42	83	107	172	36	82	58	25	48	32
25	60	2	4.72	33	72	145	11	23	23	8	13	12
26	60	2	7.07	24	66	187	9	29	25	6	17	13
27	60	2	9.42	31	59	220	12	35	22	9	20	12

Consolidated results of the experimental investigation of maize grain comminution using the improved disk mill

№	n, rpm	β, °	z, pcs	Productivity Q, kg/h				Power N, W				Specific energy consumption q, kW·h/t				Dust fraction share in ground mass *a*, %				Grinding degree λ			
				1	2	3	Average	1	2	3	Average	1	2	3	Average	1	2	3	Average	1	2	3	Average
1	1500	10	9	174	176	171	173.8	709	709	703	707.2	4.1	4.0	4.1	4.1	5.2	4.9	5.4	5.16	5.4	5.5	5.4	5.45
2	1500	20	6	155	149	153	152.5	661	697	631	663.1	4.3	4.7	4.1	4.3	5.2	5.2	5.4	5.29	5.6	5.6	5.8	5.64
3	1500	20	12	146	145	152	147.5	703	685	691	693.2	4.8	4.7	4.5	4.7	5.6	5.4	5.5	5.50	5.5	5.5	5.5	5.46
4	1500	30	9	143	145	146	144.5	685	685	697	689.1	4.8	4.7	4.8	4.8	5.8	5.7	5.7	5.72	5.7	5.6	5.7	5.69
5	2250	10	6	179	173	174	175.3	721	733	721	725.2	4.0	4.2	4.1	4.1	6.2	6.2	6.3	6.25	5.9	6.0	6.0	5.94
6	2250	10	12	162	168	162	164.4	751	727	769	749.2	4.6	4.3	4.7	4.6	6.6	6.6	6.3	6.47	6.0	6.0	6.0	6.01
7	2250	20	9	176	177	173	175.3	733	739	727	733.2	4.2	4.2	4.2	4.2	5.7	5.5	5.9	5.72	5.9	5.8	6.0	5.92
8	2250	20	9	174	171	173	172.6	722	715	727	721.5	4.2	4.2	4.2	4.2	5.6	5.7	5.7	5.74	6.0	6.1	6.1	6.07
9	2250	20	9	177	182	174	177.8	736	769	745	750.3	4.2	4.2	4.3	4.2	5.8	5.6	5.5	5.56	6.1	6.1	6.1	6.09
10	2250	30	6	148	150	143	147.0	697	715	685	699.2	4.7	4.8	4.8	4.8	6.7	6.8	7.1	6.85	6.6	6.5	6.7	6.58
11	2250	30	12	137	136	139	137.1	727	703	691	707.2	5.3	5.2	5.0	5.2	7.1	7.4	7.3	7.27	6.8	6.9	6.8	6.84
12	3000	10	9	198	210	203	203.6	721	727	715	721.2	3.6	3.5	3.5	3.5	6.7	6.5	6.6	6.61	6.9	7.0	7.0	6.99
13	3000	20	6	173	173	168	171.4	679	661	673	671.1	3.9	3.8	4.0	3.9	6.8	6.9	6.8	6.86	7.0	7.0	7.0	7.01
14	3000	20	12	152	153	148	151.0	715	721	715	717.2	4.7	4.7	4.8	4.8	7.0	7.2	7.1	7.12	7.5	7.5	7.6	7.55
15	3000	30	9	162	164	158	161.4	691	739	709	713.2	4.3	4.5	4.5	4.4	7.1	7.1	7.3	7.14	7.5	7.5	7.5	7.48

Consolidated results of the experimental investigation of wheat grain comminution using the improved disk mill

№	n, rpm	β, °	z, pcs	Productivity Q, kg/h				Power N, W				Specific energy consumption q, kW·h/t				Dust fraction share in ground mass *a*, %				Grinding degree λ			
				1	2	3	Average	1	2	3	Average	1	2	3	Average	1	2	3	Average	1	2	3	Average
1	1500	10	9	188	185	186	186.5	668	680	680	676.2	3.6	3.7	3.6	3.6	1.8	1.8	1.8	1.81	3.0	2.9	2.9	2.95
2	1500	20	6	165	171	160	165.2	614	584	656	618.1	3.7	3.4	4.1	3.7	1.8	1.8	1.9	1.83	3.0	3.0	3.1	3.02
3	1500	20	12	151	155	156	154.0	686	734	674	698.3	4.5	4.8	4.3	4.5	1.9	1.9	2.0	1.92	3.0	2.9	2.9	2.96
4	1500	30	9	155	146	146	149.0	626	638	650	638.1	4.1	4.4	4.4	4.3	2.0	2.0	2.0	1.99	3.1	3.0	3.1	3.08
5	2250	10	6	200	198	197	198.2	656	626	656	646.1	3.3	3.2	3.3	3.3	2.1	2.1	2.2	2.12	3.2	3.2	3.2	3.21
6	2250	10	12	178	188	185	183.7	728	722	728	726.4	4.1	3.8	3.9	4.0	2.2	2.2	2.3	2.24	3.2	3.2	3.2	3.20
7	2250	20	9	193	193	190	192.1	698	656	722	692.3	3.6	3.4	3.8	3.6	1.9	2.0	2.0	1.95	3.2	3.3	3.1	3.20
8	2250	20	9	196	198	192	195.2	711	668	734	704.5	3.6	3.4	3.8	3.6	1.9	1.9	2.0	1.94	3.2	3.3	3.3	3.26
9	2250	20	9	191	180	192	187.3	695	759	698	717.2	3.6	4.2	3.6	3.8	2.0	2.0	2.1	2.01	3.3	3.2	3.3	3.29
10	2250	30	6	161	166	165	164.1	632	626	662	640.1	3.9	3.8	4.0	3.9	2.3	2.3	2.3	2.30	3.6	3.6	3.5	3.58
11	2250	30	12	150	155	150	151.2	698	704	692	698.3	4.7	4.6	4.6	4.6	2.4	2.4	2.5	2.44	3.6	3.8	3.6	3.71
12	3000	10	9	217	215	225	219.0	680	656	686	674.2	3.1	3.1	3.0	3.1	2.3	2.4	2.4	2.37	3.7	3.7	3.6	3.72
13	3000	20	6	190	195	192	192.1	620	626	590	612.0	3.3	3.2	3.1	3.2	2.3	2.3	2.4	2.33	3.6	3.7	3.8	3.74
14	3000	20	12	158	156	158	157.4	692	668	674	678.3	4.4	4.3	4.3	4.3	2.4	2.4	2.5	2.44	4.0	4.0	4.0	3.98
15	3000	30	9	178	165	173	171.9	650	614	686	650.2	3.7	3.7	4.0	3.8	2.4	2.4	2.5	2.41	3.9	3.9	4.0	3.95

Consolidated results of the experimental investigation of barley grain comminution using the improved disk mill

№	n, rpm	β, °	z, pcs	Productivity Q, kg/h				Power N, W				Specific energy consumption q, kW·h/t				Dust fraction share in ground mass *a*, %				Grinding degree λ			
				1	2	3	Average	1	2	3	Average	1	2	3	Average	1	2	3	Average	1	2	3	Average
1	1500	10	9	132	127	128	128.8	803	761	831	798.0	6.1	6.0	6.5	6.2	1.4	1.4	1.5	1.44	3.0	3.0	3.0	3.04
2	1500	20	6	114	113	114	114.0	775	775	824	791.1	6.8	6.8	7.2	6.9	1.4	1.5	1.5	1.45	3.2	3.0	3.1	3.10
3	1500	20	12	107	104	111	107.3	810	782	831	807.4	7.6	7.5	7.5	7.5	1.5	1.5	1.6	1.54	3.0	3.0	3.0	3.03
4	1500	30	9	112	113	108	111.0	789	775	782	781.8	7.0	6.8	7.3	7.0	1.6	1.6	1.6	1.60	3.1	3.2	3.1	3.18
5	2250	10	6	137	137	143	138.8	817	796	831	814.3	6.0	5.8	5.8	5.9	1.7	1.7	1.7	1.71	3.3	3.4	3.3	3.33
6	2250	10	12	123	131	123	125.8	852	817	845	837.6	6.9	6.2	6.9	6.7	1.8	1.8	1.8	1.80	3.3	3.2	3.3	3.28
7	2250	20	9	129	129	128	128.4	838	838	824	832.9	6.5	6.5	6.5	6.5	1.5	1.6	1.6	1.57	3.3	3.3	3.3	3.30
8	2250	20	9	130	130	124	128.1	849	852	852	850.8	6.5	6.6	6.8	6.6	1.5	1.6	1.6	1.55	3.4	3.2	3.4	3.35
9	2250	20	9	131	129	131	130.3	860	873	866	866.1	6.6	6.8	6.6	6.6	1.5	1.6	1.6	1.58	3.4	3.3	3.3	3.38
10	2250	30	6	112	112	111	111.7	789	775	796	786.4	7.0	6.9	7.2	7.0	1.8	1.9	1.9	1.86	3.6	3.8	3.7	3.70
11	2250	30	12	104	101	103	102.9	817	796	796	802.7	7.8	7.9	7.7	7.8	2.0	2.0	2.1	2.02	3.8	3.8	3.8	3.82
12	3000	10	9	150	143	149	147.3	817	852	754	807.4	5.4	5.9	5.1	5.5	1.8	1.9	1.9	1.87	3.9	3.7	3.8	3.82
13	3000	20	6	125	120	125	123.6	782	810	754	781.8	6.2	6.8	6.0	6.3	1.9	1.9	1.9	1.89	3.8	3.9	3.9	3.84
14	3000	20	12	114	115	110	113.2	810	782	831	807.4	7.1	6.8	7.6	7.1	1.9	2.0	2.0	1.97	4.1	4.1	4.2	4.10
15	3000	30	9	123	127	123	124.3	775	782	754	770.1	6.3	6.2	6.1	6.2	2.0	2.0	2.0	1.99	4.1	4.1	4.1	4.10