

ThermalNet

Work Package 2C

Feedstock and Standards

Vienna

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Contents

- Review of the deliverables
- CEN Standards
- Biomass Feedstocks – quantification
- Critical elements of Feedstocks – classification

Deliverables

- Standards for feedstock production
- Current production levels for each feedstock
- Potential for each feedstock
- Identification of the critical elements of each feedstock

CEN Standards

Standard reference	Title
CEN/TS 14588:2004	Solid biofuels - Terminology, definitions and descriptions
CEN/TS 14774-1:2004	Solid biofuels - Methods for determination of moisture content - Oven dry method - Part 1: Total moisture - Reference method
CEN/TS 14774-2:2004	Solid biofuels - Methods for the determination of moisture content - Oven dry method - Part 2: Total moisture - Simplified method
CEN/TS 14774-3:2004	Solid biofuels - Methods for the determination of moisture content - Oven dry method - Part 3: Moisture in general analysis sample
CEN/TS 14775:2004	Solid biofuels - Method for the determination of ash content
CEN/TS 14778-1:2005	Solid biofuels - Sampling - Part 1: Methods for sampling
CEN/TS 14778-2:2005	Solid biofuels - Sampling - Part 2: Methods for sampling particulate material transported in lorries
CEN/TS 14779:2005	Solid biofuels - Sampling - Methods for preparing sampling plans and sampling certificates
CEN/TS 14780:2005	Solid biofuels - Methods for sample preparation
CEN/TS 14918:2005	Solid Biofuels - Method for the determination of calorific value
CEN/TS 14961:2005	Solid biofuels - Fuel specifications and classes
CEN/TS 15103:2005	Solid biofuels - Methods for the determination of bulk density
CEN/TS 15104:2005	Solid biofuels - Determination of total content of carbon, hydrogen and nitrogen - Instrumental methods

Standard reference	Title
CEN/TS 15105:2005	Solid biofuels - Methods for determination of the water soluble content of chloride, sodium and potassium
CEN/TS 15148:2005	Solid biofuels - Method for the determination of the content of volatile matter
CEN/TS 15149-1:2006	Solid biofuels - Methods for the determination of particle size distribution - Part 1: Oscillating screen method using sieve apertures of 3,15 mm and above
CEN/TS 15149-2:2006	Solid biofuels - Methods for the determination of particle size distribution - Part 2: Vibrating screen method using sieve apertures of 3,15 mm and below
CEN/TS 15149-3:2006	Solid biofuels - Methods for the determination of particle size distribution - Part 3: Rotary screen method
CEN/TS 15150:2005	Solid biofuels - Methods for the determination of particle density
CEN/TS 15210-1:2005	Solid biofuels - Methods for the determination of mechanical durability of pellets and briquettes - Part 1: Pellets
CEN/TS 15210-2:2005	Solid biofuels - Methods for the determination of mechanical durability of pellets and briquettes - Part 2: Briquettes
CEN/TS 15234:2006	Solid biofuels - Fuel quality assurance
CEN/TS 15289:2006	Solid Biofuels - Determination of total content of sulphur and chlorine
CEN/TS 15290:2006	Solid Biofuels - Determination of major elements
CEN/TS 15296:2006	Solid Biofuels - Calculation of analyses to different bases
CEN/TS 15297:2006	Solid Biofuels - Determination of minor elements
CEN/TS 15370-1:2006	Solid Biofuels - Method for the determination of ash melting behaviour - Part 1: Characteristic temperatures method

Biomass Feedstocks

- **Table 1** - Data of total area and areas of interest for biomass production for each member of EU-27; area data in millions of hectares
- **Table 2** - Gross inland consumption RES per member state and contribution of biomass in 2004* (Mtoe)
- **Table 3** - Agriculture basic data in the EU 27 in 2005* (kha)
- **Table 4** - Crop yields in the EU 27 for wheat, rapeseed, sunflower, sugar beet and maize in t/ha in the year 2005*
- **Table 5** - Energy crop potential in EU-27, depending on percentage of utilised arable land and achieved crop yield

Table 1 – Data of total area of biomass production

	Total area (106Ha)	Agricultural area (106Ha)	Arable land (106Ha)(% of total area)		Hectares of agricultural land per capita
Austria	8.4	3.4	1.4	17	0.42
Belgium	3.1	1.4	0.8	27	0.13
Bulgaria	11.1	5.3	3.3	30	0.68
Cyprus	0.9	0.1	0.1	11	0.18
Czech Republic	7.9	4.3	3.1	39	0.42
Denmark	4.3	2.7	2.3	53	0.49
Estonia	4.5	0.8	0.5	12	0.63
Finland	33.8	2.2	2.2	7	0.43
France	55.2	29.7	18.5	33	0.49
Germany	35.7	17.0	11.8	33	0.21
Greece	13.2	8.4	2.7	20	0.77
Hungary	9.3	5.9	4.6	50	0.6
Ireland	7.0	4.4	1.2	17	1.09

	Total area (106Ha)	Agricultural area (106Ha)	Arable land (106Ha)(% of total area)		Hectares of agricultural land per capital
Italy	30.1	15.1	8.0	26	0.26
Latvia	6.5	2.5	1.8	28	1.08
Lithuania	6.5	3.5	2.9	45	1.02
Luxemburg	0.3	0.1	0.06	24	0.28
Malta	0.03	0.01	0.01	31	0.03
Netherlands	4.2	1.9	0.9	22	0.12
Poland	31.3	16.2	12.6	40	0.42
Portugal	9.2	3.7	1.6	17	0.37
Romania	23.8	14.7	9.4	39	0.66
Slovakia	4.9	2.4	1.4	29	0.45
Slovenia	2.0	0.5	0.2	9	0.26
Spain	50.5	30.2	13.7	27	0.73
Sweden	45.0	3.2	2.7	6	0.36
U.K.	24.4	17.0	5.7	23	0.28
EU-27	433.1	196.6	113.5	26	0.41

Table 2 – Gross Inland Consumption for RES

	Gross inland consumption Mtoe	Renewables	Biomass	Share of RES of GIC (%)	Share of Biomass related to GIC (%)
		Mtoe	Mtoe		
Austria	32.7	6.77	3.45	20.7	10.55
Belgium	54.8	1.16	1.12	2.11	2.04
Bulgaria	-	-	-	-	-
Cyprus	2.5	0.09	0.005	3.6	0.2
Czech Republic	43.6	1.36	1.19	3.12	2.72
Denmark	20	2.93	2.37	14.6	11.85
Estonia	5.6	0.61	0.60	10.89	10.7
Finland	37.7	8.80	7.49	23.34	19.86
France	273.7	17.30	11.92	6.32	4.35
Germany	347.7	13.76	9.37	3.95	2.69
Greece	30.6	1.56	0.95	5.09	3.1
Hungary	26.2	0.97	0.86	3.7	3.28
Ireland	15.7	0.32	0.21	2.03	1.33

	Gross inland consumption Mtoe	Renewables	Biomass	Share of RES of GIC (%)	Share of Biomass related to GIC (%)
		Mtoe	Mtoe		
Italy	184.8	12.53	3.79	6.78	2.05
Latvia	4.6	1.65	1.37	35.86	29.78
Lithuania	9.2	0.73	0.69	7.93	7.5
Luxemburg	4.7	0.07	0.05	1.48	1.06
Malta	0.9	-	-	-	-
Netherlands	82.3	2.36	2.17	2.86	2.63
Poland	92.5	4.32	4.12	4.67	4.45
Portugal	26.2	3.89	2.87	14.84	10.95
Romania	-	-	-	-	-
Slovak Rep.	18.6	0.74	0.38	3.97	2.04
Slovenia	7.1	0.82	0.47	11.54	6.61
Spain	140.2	8.98	4.85	6.4	3.45
Sweden	53.1	14.13	8.88	26.61	16.72
U.K.	232.1	3.67	3.05	1.58	1.31
EU25**	1747.2	109.53	72.274	6.26	4.13

** Data from Romania & Bulgaria missing

Table 3 - Agriculture Basic Data

	UAA as a share of total land area (%)	Arable land	Permanent grassland	Permanent crops	Set aside** land in kha	Set aside land in % (related to arable land)
Austria	39.4	1379	1810	66	107	7.75
Belgium	45.8	843	519	21	24	2.84
Bulgaria	49.0	3297	1801	216	293	8.88
Cyprus	-	87	1	37	-	-
Czech Republic	46.7	2703	853	42	70	2.58
Denmark	62.8	2470	228	10	213	8.62
Estonia	18.2	517	236	2	-	-
Finland	7.4	2234	26	4	177	7.92
France	54.6	18305	10039	1123	1489	8.13
Germany	-	11903	4929	198	1137	9.55
Greece	-	2619	-	1133	30	1.14
Hungary	65.4	4502	1057	207	215	4.77
Ireland	62.5	1205	3098	2	29	2.40
Italy	49.9	7713	4411	2463	231	2.99

	UAA as a share of total land area (%)	Arable land	Permanent grassland	Permanent crops	Set aside** land in kha	Set aside land in % (related to arable land)
Latvia	27.8	1092	629	13	-	-
Lithuania	45.3	1877	891	40	300	15.98
Luxemburg	50.4	60	68	2	-	-
Malta	32.4	9	-	1	-	-
Netherlands	57.0	1117	763	32	16	1.43
Poland	52.3	12085	3388	351	130	10.7
Portugal	40.5	1418	1507	773	80	5.64
Romania	62.3	9017	4665	413	500	5.54
Slovak Rep.	40.4	1357	524	26	29	2.13
Slovenia	25.3	176	305	28	10	5.68
Spain	51.4	12608	7264	5659	1329	10.54
Sweden	7.9	2668	555	3	264	9.89
U.K.	69.6	5484	5711	32	567	10.33
EU25**	-	108745	55278	12897	7240	6.66

* Key figures on Europe Statistical Pocketbook 2006, Euro stat

** Bio-Energy's role in the EU Energy Market, a view of developments until 2020 Report to the European Commission

Table 4 - Crop Yields

	Wheat	Rapeseed	Sunflower	Sugar beet	Maize
Austria	5.08	2.96	2.67	70.85	10.31
Belgium	8.42	4.25		69.95	11.69
Bulgaria	3.14	1.98	1.47	19.11	5.31
Cyprus					
Czech Republic	5.05	2.88	2.39	53.31	7.17
Denmark	7.23	3.06		58.75	
Estonia	3.08	1.78			
Finland	3.72	1.37		37.74	
France	7.18	3.68	2.33	82.32	8.37
Germany	7.47	3.76	2.47	60.18	9.21
Greece	2.70		1.25	65.88	9.0
Hungary	4.49	1.0	2.16	57.03	7.56
Ireland	8.43	3.15		45.00	
Italy	5.45	1.72	2.22	55.94	9.39
Latvia	3.61	2.04		38.51	3.06

	Wheat	Rapeseed	Sunflower	Sugar beet	Maize
Lithuania	3.73	1.84		38.02	
Luxemburg	6.02	3.62			9.58
Malta					
Poland	3.95	2.64	1.71	41.62	5.73
Portugal	6.7		0.34	70.14	4.66
Romania	2.97	1.68	1.38	28.93	4.01
Slovak Rep.	4.28	2.19	2.12	52.42	7.04
Slovenia	4.7	2.37	2.22	51.43	8.29
Spain	2.21	1.13	0.69	71.33	9.68
Sweden	6.34	2.42		48.41	
Netherlands	8.66	3.69		64.95	12.2
U.K.	7.96	3.29	2	57.31	
EU 27	5.99	3.22		60.37	8.4

* Average yield figures obtained from Euro stat

Table 5 - Energy Crop Potential

Yield	10% arable land in EU-27		20% arable land in EU-27		30% arable land in EU-27	
10t TS/ha	2,042 PJ	46Mtoe	4,084 PJ	91Mtoe	6,127 PJ	137Mtoe
20t TS/ha	4,084 PJ	91Mtoe	8,169 PJ	182Mtoe	12,253 PJ	274Mtoe
30t TS/ha	6,127 PJ	137Mtoe	12,253 PJ	274Mtoe	18,380 PJ	410Mtoe

Critical Elements of Feedstocks – Classification

- Characterisation of biofuels

Ash content

Calorific value

Volatile Matter

C,H,N,S,CL

As, Cr, Ti, Zn, Ba, Cu, Ni, Pb, Cd,Hg

Critical Elements of Feedstocks – Classification

- Characterisation of ashes

CO₂, SO₃, Cl

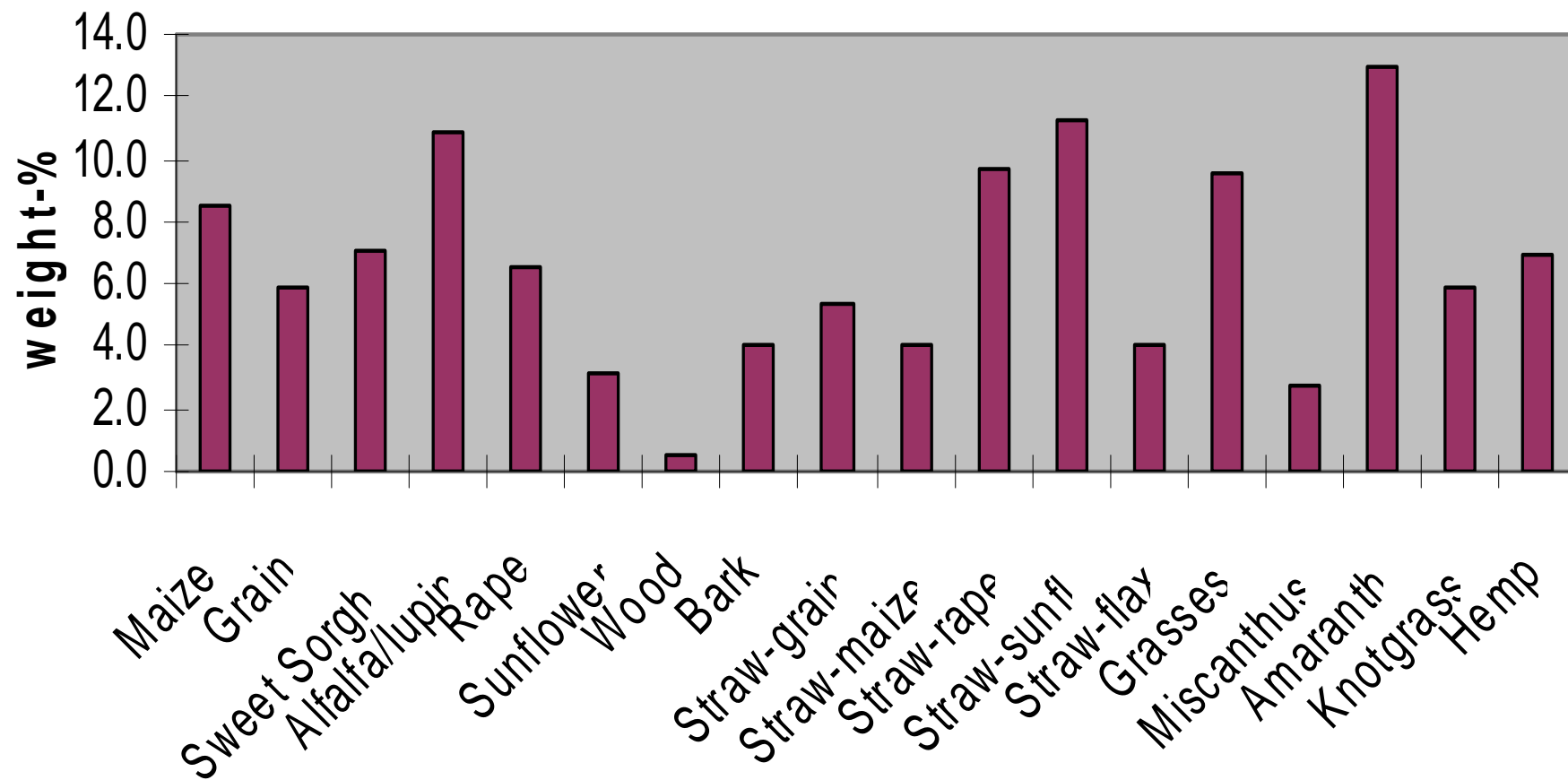
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- Sintering temperature
- Softening temperature
- Hemispherical temperature
- Fusion temperature

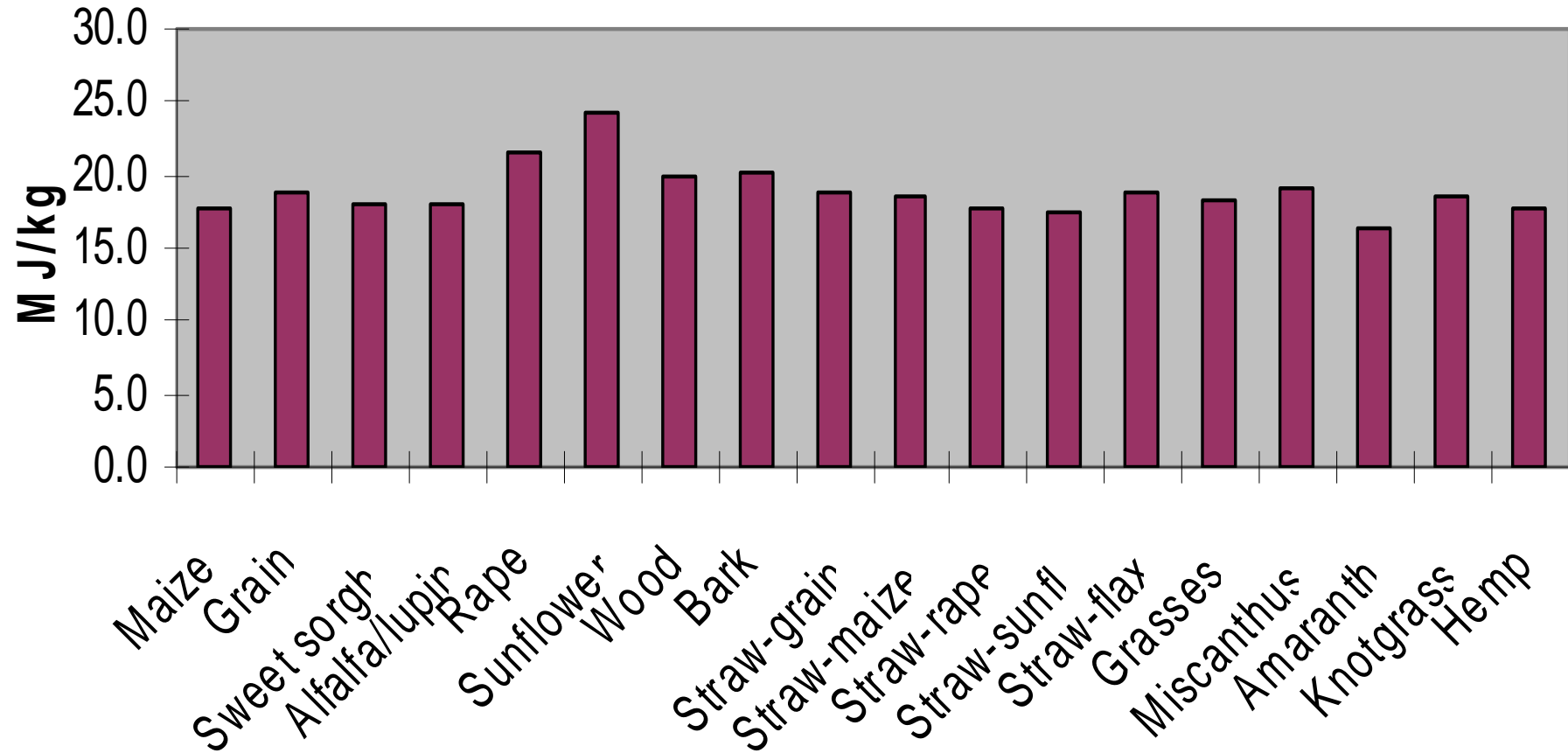
Biomass Properties

	Ash Melti ng	C	H	N	S	Cl	Calorific Content
Rape	1450	50.46	6.26	2.07	0.53	0.45	20170
Sunflower	1140	57.56	6.48	1.65	0.13	0.1	22700
Wood	1470	50.88	5.62	0.11	0.01	0.01	18660
Bark	1400	51.57	5.07	0.42	0.05	0.02	19280
Straw-grain	940	47.14	5.33	0.46	0.07	0.48	17480
Straw-Maize	1010	46.91	5.47	0.56	0.04	0.25	17270
Straw-rape	1380	44.66	5.13	1.4	0.3	0.98	16480
Straw-sunflower	760	44.62	5.1	1.1	0.11	0.72	16380
Straw-flex	1020	47.82	5.38	0.67	0.14	0.32	17900
Grass	970	45.83	5.08	2.23	0.18	0.88	17170
Miscanthus	880	48.57	5.45	0.45	0.04	0.23	17900
Amaranth	1290	41.14	4.75	1.81	0.26	0.56	15400
Knotgrass	760	47.07	5.41	1.08	0.12	0.48	17310
Hemp	1700	44.83	5.17	0.99	0.07	0.16	16460
Willow	1452	50.2	5.9	0.1	0.02	0.01	17247
Reed Canary Grass	892	45.26	5.7	1.4	0.14	0.064	17126
Poplar	1463	50.72	6.26	0.13	0.01	0.02	16404

Ash content of biofuels



Net calorific value of biofuels



Classification of Thermal ash behaviour

class	explanation	boundary
A	high softening	softening temperature °C > 1150
B	medium softening	950 – 1150
C	low softening	< 950

Classification of Nitrogen Content

class	explanation	boundary
1	“woodlike”	<0.3
2	“strawlike”	0.3 – 1.0
3	“N-rich”	> 1.0

nitrogen content w-%

Classification of Chlorine Content

class	explanation	boundary
		chlorine content w -%
1	“woodlike”	<0.15
2	“strawlike”	0.15 – 0.6
3	“Cl-rich”	>0.6

Biomass Categorisation

Biomass Type	Ash	N	Cl
Rape	A	3	2
Sunflower	B	3	2
wood	A	1	1
bark	A	2	1
straw-grain	C	2	2
straw-maize	B	2	2
straw-rape	A	3	3
straw-sunflower	C	3	3
straw - flex	B	2	2
Grass	C	3	3
Miscanthus	C	2	2
Amaranth	A	3	2
Knotgrass	C	3	2
Hemp	A	2	2
Willow	A	1	1
Reed Canary	C	3	1
Poplar	A	1	1

Thank You

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