Biomass production on the ProLoc-site Trenthorst (Bio26)

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Abstract

The idea to assess clone-site interactions for poplar and willow on agricultural land could be realized in the ProLoc project. One site is managed in a 3-year rotation period by the Thünen Institute. So far three harvests have been made. Biomass production increased from harvest to harvest. The 2 willows clones have a higher biomass production than the 3 poplar clones tested.

Key words: *Populus, Salix,* clone, SRC

Background

To assess clone-site interactions for growing poplar and willow clones on agricultural land, 38 study sites were established throughout Germany (Figure 1). Soil parameters, yield and vitality data were recorded. Thus in this project, for the first time, a universal experimental design was used for the establishment of trial sites across as many regions as possible in Germany, which were then analyzed jointly (HOFMANN et al. 2012, STIEHM et al. 2015). Correlations between particular site variables with total yield were estimated and tested for causality. Empirical statistics was used to develop algorithms with the parameters variety/clone, soil and climate (AMTHAUER GALLARDO 2014). One site is operated by the Thünen Institute.

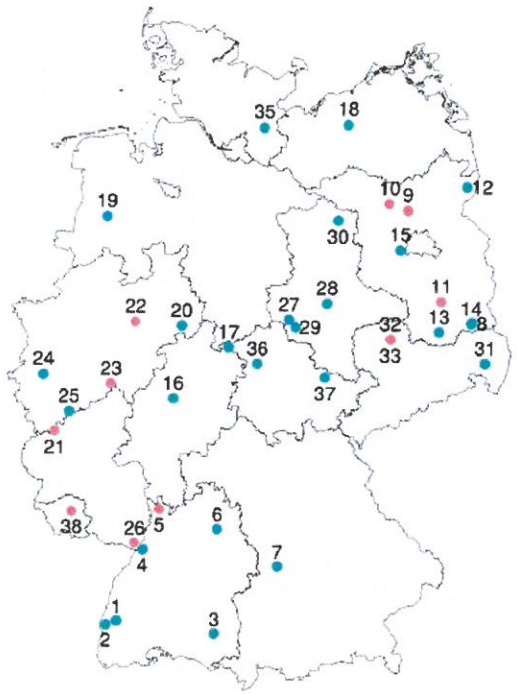

Figure 1: Trial sites of the ProLoc poject (35= Trenthorst / Schleswig-Holstein)

Material and methods

In total 5 variants, two willow varieties (Inger, Tordis) and three well known poplar clones (Max 1, Hybrid 275, AF2) were planted as unrooted cuttings (20 cm) at a spacing of 1.8 m x 0.5 m. The site Trenthorst / Schleswig-Holstein (Bio26; 53° 47' N, 10° 31' E, 37 m a.s.l.) was established in spring 2008. A plot was established with 5 rows and 20 plants each (100 plants per plot). This results in a plot size of 9 m * 10 m (90 m^2). The variants were planted in a randomized one factorial block design at each site with 4 replications (Figure 2).

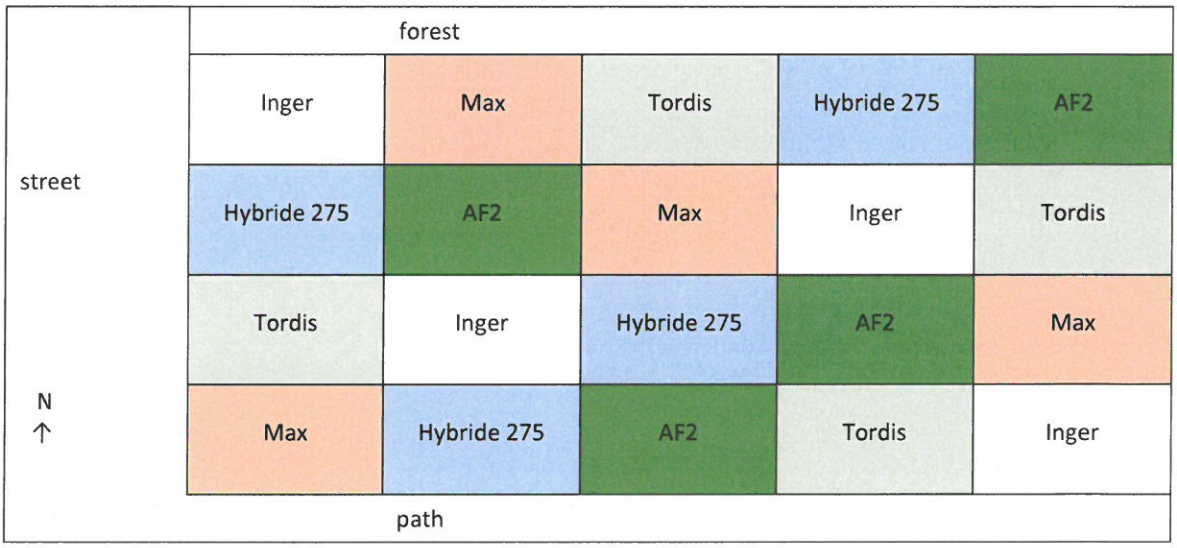

Figure 2: Lay-out of the ProLoc-site in Trenthorst (Bio26).

The site was managed in a 3-year rotation period. So far three harvests have been made. To calculate the above-ground woody biomass which was grown in the first 3-year rotation circle a sample of 24 trees per plot was harvested and weighted. The sample for the second 3 year rotation circle was reduced to 16 trees per plot. The biomass for the third circle was determined by harvesting and weighting the complete biomass of a plot. In each of the 3 harvests a sample was taken to determine the water content. Therefore, these samples were dried in an oven by 104 °C until weight was constant.

Results

The willow clones are producing more biomass (metric tons absolutely dried matter) than the poplar clones within 3 rotation periods. The biomass production on the site Trenthorst increases from rotation circle to the next rotation circle.

The total biomass production in the first rotation period was very low. An average of 3.2 t d.m. ha^{-1} was calculated over the 5 clones. The biomass production varied between 0.9 t d.m./ha for the poplar clone 'Hybride 275' and 5.7 t d.m. ha^{-1} for the willow clone 'Inger'. Differences between clones are significant.

During the second rotation period the biomass yield increased. On average a biomass of 29.7 t d.m. ha^{-1} was harvested. Between the clones the biomass production varied between 17.7 t d.m. ha^{-1} for the poplar clone 'Hybride 275' and 38.4 t d.m. ha^{-1} for the willow clone 'Inger'. Differences between clones were significant.

In the third rotation period the biomass production increased again. On average 37.8 t d.m. ha^{-1} biomass was produced. The willow clone 'Tordis' (51.9 t d.m. ha^{-1}) had the best performance. The lowest biomass production had the poplar clone 'AF2' (25.5 t d.m. ha^{-1}). The willow clones were significant better in biomass production than the poplar clones.

The total biomass production per rotation period is given in Table 1. The mean annual increment per clone and rotation period is shown Figure 3.

Table 1: Above-ground woody biomass production [t d.m. ha^{-1}] per clone and rotation circle

Genus	Clone	1. rotation	2. rotation	3. rotation
Poplar	Max 1	4.5	32.7	31.5
	Hybride 275	0.9	17.7	31.2
	AF2	2.4	22.8	25.5
Willow	Inger	5.7	38.4	48.9
	Tordis	2.7	36.9	51.9

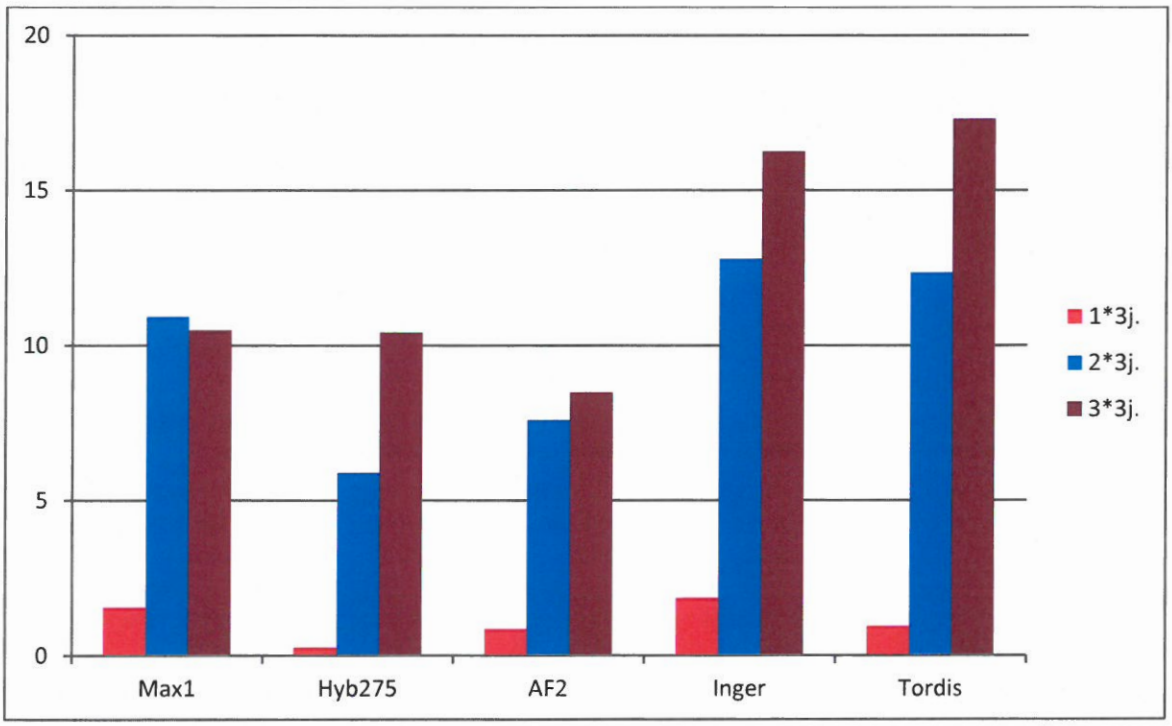

Figure 3: Mean annual increment [t d.m. ha^{-1} a^{-1}] per clone and rotation circle.

The mean annual biomass production of the first and second rotation period is listed for all sites of the ProLoc project in Table 2. The annual increment is very low in the first rotation circle on the site Trenthorst (VFL-Nr. 35) compared to other ProLoc sites. While after the second rotation the annual increment is at average.

Table 2: Mean annual biomass production [t d.m. ha^{-1} a^{-1}] in two 3-year rotation periods (Source: STIEHM et al. 2017) (1. Rotation= '10, 2. Rotation= '13)

VFL-Nr.	Max 1 '10	Max 1 '13	Hyb. 275 '10	Hyb. 275 '13	AF2 '10	AF2 '13	Inger '10	Inger '13	Tordis '10	Tordis '13
1	7.67	13.61	7.42	16.84	6.33	6.85	8.29	11.53	8.99	11.64
2	7.32	10.76	3.29	8.63	6.57	6.67	1.65	3.88	1.98	6.75
3	10.00	10.80	5.64	9.51	8.36	7.50	7.90	12.12	7.20	21.67
4	5.46	7.83	4.41	9.90	4.52	4.19	2.76	3.50	2.26	1.20
6	3.77	12.03	0.64	6.53	3.84	9.01	2.76	8.72	0.93	5.52
7	0.72	5.47	1.62	7.87	2.65	6.66	2.38	5.97	2.25	6.93
8	0.44	1.10	0.45	1.56	0.48	1.25	0.29	0.27	0.13	0.18
9	5.89	-	2.92	-	4.27	-	2.83	-	2.08	-
12	1.96	3.00	1.97	3.42	0.87	1.49	1.91	2.17	1.72	2.66
13	4.63	7.30	3.87	7.40	3.58	3.61	3.43	3.23	4.75	5.53
14	0.17	1.66	0.25	1.72	0.21	2.15	0.18	0.54	0.08	0.46
15	4.51	11.51	3.37	12.56	6.23	13.53	3.80	16.40	3.92	17.10
16	3.25	13.13	1.11	12.08	4.83	12.46	4.72	15.35	4.70	18.63
17	10.09	12.65	10.21	13.74	8.76	11.84	9.13	13.81	9.97	12.89
18	1.39	9.03	0.55	5.77	0.77	5.45	1.39	6.89	0.75	6.21
19	6.43	11.99	1.15	6.89	7.26	11.57	9.23	16.32	9.14	16.23
20	2.06	9.70	1.46	11.29	1.48	7.56	1.82	12.50	1.96	12.47
24	7.06	6.17	3.70	4.96	7.02	6.24	9.49	7.71	9.43	7.46
25	9.61	14.05	9.07	16.48	9.25	19.11	6.95	10.94	8.01	11.76
27	1.02	5.31	0.94	5.60	0.62	0.87	1.46	1.91	1.12	1.20
28	10.14	11.89	8.06	10.91	11.05	11.21	10.60	7.85	9.99	8.21
29	8.41	13.84	7.49	15.02	6.90	11.25	8.28	9.47	8.08	11.80
30	0.37	2.25	0.50	1.40	1.77	4.60	0.84	2.20	0.41	0.96
31	7.36	11.68	8.88	13.01	6.61	5.09	8.08	12.14	9.10	12.73
35	1.55	10.93	0.26	5.90	0.85	7.60	1.85	12.80	0.94	12.35
36	4.92	10.36	2.45	5.48	7.12	10.56	7.04	9.01	6.73	12.95
37	7.39	15.47	4.77	11.87	5.82	14.08	6.71	12.01	7.33	12.82

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