Autotetraploids: Field performance of tetraploid and corresponding diploid stocks. W. Friedt, Biologische Bundesanstalt für Land- und Forstwirtschaft, Institut für Resistenzgenetik, Grünback, D-8059 Bockhorn, Federal Republic of Germany.

As anticipated in BGN 11 (Friedt, 1981), the collection of tetraploid barley was grown again at Grünbach in 1981 for seed multiplication. Afterwards, 10,000 seeds of each pure-breeding stock were transferred for long-term storage to the German Genebank, Institut für Pflanzenbau und Pflanzenzüchtung (FAL), D-3300 Braunschweig-Völkenrode (FRG). However, limited amounts of seed can still be requested from our Institute.

A list of available, pure stocks is given below (Table 1). Therein, also the grain yield as determined in single drill plots is given. The yield data are summarized in Figure 1, where the frequency distributions for grain yield of autotetraploid and original diploid parents are compared. It is evident that the yield of the former is generally much lower than that of the latter, although some of the older diploid stocks are comparatively poor yielding. Even the highest yielding tetraploids, i.e. Nos. 629, 630, 632 and 641, did not yield more than 50-60% of the best diploid parent (No. 470).

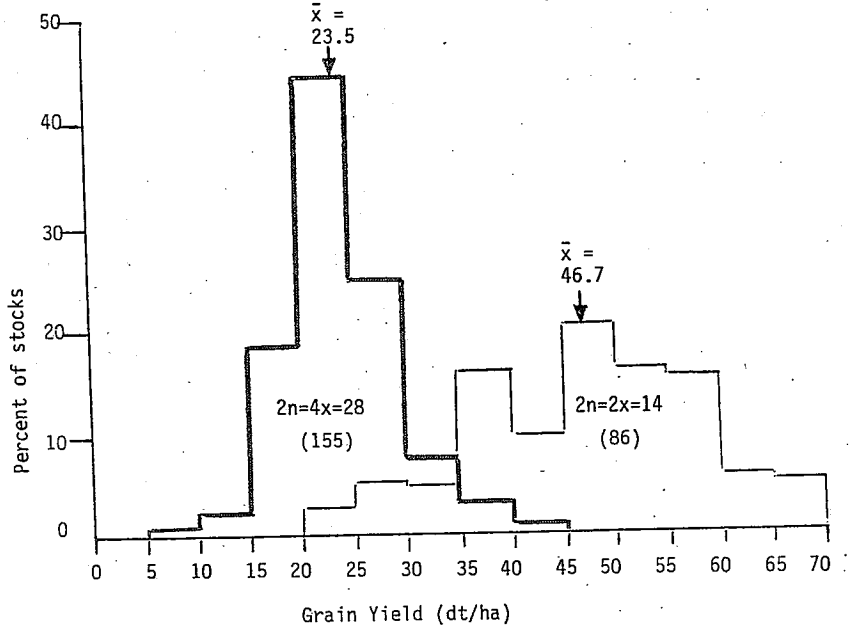

Figure 1. Frequency distributions for grain yield of autotetraploid (2n=4x=28) and corresponding diploid (2n=2x=14) stocks of spring barley, 1981.

Table 1. Collection of tetraploid barley.

A. Diploid parents (2n=2x=14)

Field No. 1981	Name/Number of Cultivar/Strain	Grain Yield (dt/ha, plot size 5 m^2, 1 rep.)
401	Brio	28
402	Edda	24
403	Kihara Mochimugi	27
404	Kihara Seiken	25
405	Alma	52
406	Ammer	49
407	Amsel	46
408	Balder	46
409	Bella	51
410	Bohemian	39
411	Brage	38
412	Busser	24
413	Ceresia	40
414	Cowra	27
415	D 8/55	44
416	D 9/55	40
417	Dioseger	35
418	Emir	51
419	ert-38	45
420	Firlbeck Stamm	39
421	Frankonia	47
422	Fuchs Pfälzer	40
423	Gerda	42
424	Gold Foil	39
425	Haisa II	51
426	frühe 31	47
427	lo 8	47
428	macrolepis	43
429	w 7	46
430	Harbin	31
431	Hatvany	33
432	Impala	48
433	Ingrid	56
434	Inis	39
435	Johanna	48
436	Kenia	67
437	Kihara early golden	32
438	Kihara Hakata	39
439	Maja	41
440	Mamie	55
441	Mari	36
442	Matura	50
443	Nota	48
444	NS Morgenrot	39
445	Ochsenhauer Ria	39
446	Opal B	46
447	Palmella blue	38
448	Primus II	49
449	Scholz Mut.4242	39
450	Skärsmö	31
451	Stanka's früh	39
452	Starnauer Kneifel	40
453	Streng's Franken III	50
454	Szekacs	36
455	Trins	25
456	Union	57
457	Villa	60
458	Volla	58
459	Weihenstephaner	49
460	Wisa	58

Field No. 1981	Name/Number of Cultivar/Strain	Grain Yield (dt/ha)
461	Ymer	57
462	W 1173/472311 (Weihenstephan)	56
463	W 1749/31681 (Weihenstephan)	57
464	48/711d (Grünbach)	53
465	50/721c (Grünbach)	62
466	79/755-15 (Grünbach)	58
467	79/756-12 (Grünbach)	61
468	90/771-21 (Grünbach)	57
469	90/772-1 (Grünbach)	59
470	297/1347 (Grünbach)	68
471	478/1370 (Grünbach)	47
472	No.5508	46
473	744/1277 (Grünbach)	66
474	744/1277(lo) (Grünb.)	67
475	548/1812 (Grünbach)	53
476	MRM 52 (Mehltauresistente Mut.Matura) Grünbach	48
477	Carina	53
478	1302/3019 (Grünbach)	52
479	224/1328 (Grünbach)	52
480	592/1839-15 (Grünb.)	52
481	681/1682-4 (Grünb.)	57
482	Karri (Ahokas)	51
483	Mutina (Grünbach)	57
484	Aramir	62
485	Kristina	62
486	M.C.20 (ml-o, Favret)	51

B. Autotetraploids (2n=4x=28) - six-rowed

Field No. 1981	Name/Number of Cultivar/Breeder's strain	Grain Yield (dt/ha)[1]
501	57-AB-5002 (Wiebe)	10
502	Barbless (Wiebe)	19
503	Big Boy (Wiebe)	19
504	Brant (Jenkins)	17
505	Brant X OAC 21 (Reinbergs)	20
506	Brant 57-754 (Reinbergs)	19
507	Brant 57-754 X GB 96 (Reinb.)	(30)[2]
508	Brio (Müntzing)	17
509	Edda (Müntzing)	29
510	Edda (Jenkins)	21
511	Everest (Wiebe)	9
512	GB 96 (Reinbergs)	23
513	Hoffmann 3520	23
514	Hoffmann 3521	20
515	Hoffmann 3522	23
516	Hoffmann 3524	22
517	Hoffmann 10/634	21
518	Hoffmann 11/344	32
519	Hosokara Nr.2 (Takahashi)	21
520	Hosomugi (Takahashi)	23
521	Kihara Mochimugi (Müntzing)	24
522	Kihara Saikon (Müntzing)	19
523	Montcalm (Reinbergs)	16
524	Nord (Reinbergs)	18
525	OAC 21 (Reinbergs)	17
526	OAC 21 (Jenkins)	17
527	Slender (Wiebe)	19
528	Traill (Reinbergs)	18
529	Walter (Wiebe)	23

1) Plot size 10 m^2, 1 replication
2) In parentheses: mixture of 2x and 4x plants

Autotetraploids cont. - two-rowed

Field No. 1981	Name/Number of Cultivar/Breeder's strain	Grain Yield (dt/ha)
531	Alma (Frimmel)	27
532	Ammer (Frimmel)	24
533	Amsel (Bender)	24
534	Balder (Müntzing)	25
535	Balder (Hoffmann)	24
536	Balder (Lange)	26
537	Bella (Frimmel)	26
538	Bohemian (Wiebe)	25
539	Brage (Müntzing)	22
540	Brage (Ellerström)	18
541	Busser (Bender)	26
542	Ceresia (Bender)	32
543	Cowra (Bender)	21
544	D 8/55 (Gaul)	29
545	D 9/55 (Gaul)	28
546	Dioseger	27
547	Emir (Frimmel)	15
548	ert 23 (Hoffmann)	23
549	ert 32 (Hoffmann)	21
550	ert 32 (Ellerström)	23
551	Firlbeck (Rommel)	34
552	Frankonia	26
553	Frederickson (Wiebe)	19
554	Fuchs Pfälzer (Bender)	20
555	Gerda (Frimmel)	24
556	Gold Foil (Rommel)	22
557	Haisa II (Gaul)	29
560	frühe 58 (Gaul) HM [1]	21
562	macrolepis (Gaul) HM	23
563	frühe 12 = W 7 (Gaul) HM	16
565	Hatvany	26
566	HES Type I (Takahashi)	12
567	Hoffmann 3500	20
568	Hoffmann 3501	21
569	Hoffmann 3502	22
570	Hoffmann 3503	22
571	Hoffmann 3504	21
572	Hoffmann 3505	21
573	Hoffmann 3506	18
575	Hoffmann 3508	20
576	Hoffmann 3509	24
577	Hoffmann 3510	22
578	Hoffmann 3511	19
579	Hoffmann 3512	21
580	Hoffmann 3513	19
581	Hoffmann 3514	21
582	Hoffmann 3515	23
583	Hoffmann 3516	22
584	Hoffmann 3517	29
585	Hoffmann 3518	20
586	Hoffmann 3519	21
587	Hoffmann 11/344	17
588	Impala (Frimmel)	28
589	Ingrid (Frimmel)	23
590	Johanna (Frimmel)	34
591	Kenia (Müntzing)	23
592	Kenia (Hoffmann)	22
593	Kihara early golden (Müntz.)	17
594	Kihara Hakata (Müntzing)	22
595	Kihara Hakata 2 (Wiebe)	27
596	Maja (Müntzing)	25
597	Maja (Hoffmann)	29
598	Mamie	28
600	Matura (Frimmel)	21
601	New Ebis (Wiebe)	28

Field No. 1981	Name/Number of Cultivar/Strain	Grain Yield (dt/ha)
602	Nota (Frimmel)	35
603	NS Morgenrot	28
604	Ochsenhauer Ria (Bender)	20
605	Opal B (Müntzing)	23
606	Opal B (Wiebe)	20
607	Palmella blue (Frimmel)	22
608	Primus II (Müntzing)	29
609	Primus II (Ellerström)	31
612	Shin Ebisu (Takahashi)	29
613	Stanka's früh (Frimmel)	28
614	Starnauer Kneifel (Bender)	27
615	Streng's Franken III(Rommel)	35
616	Szekacs	20
617	Ulonska's nackt	28
618	Ulonska's 41/18	28
619	Ulonska's 41/65	28
620	Union (Bender)	29
621	Villa (Friedt)	31
622	Volla (Frimmel)	29
623	Wasegoru (Takahashi)	21
624	Weihenstephaner MR (Gaul)	30
625	Wisa (Rommel)	26
626	Ymer (Müntzing)	25
627	Ymer (Ellerström)	25
628	Ymer (Hoffmann)	26
629	W 1173/472311 (Frimmel)	35
630	W 1749/31681 (Frimmel)	37
631	48/711-d (Friedt)	23
632	50/721-c (Friedt)	41
633	79/755-15 (Friedt)	20
634	79/756-12 (Friedt)	20
635	90/771-21 (Friedt)	22
636	90/772-1 (Friedt)	21

Field No. 1981	Name/Number of Cultivar/Strain	Grain Yield (dt/ha)
637	297/1347 (Friedt)	26
638	478/1370 (Friedt)	22
639	744/1277 (Friedt)	15
640	744/1277-locker (Friedt)	29
641	744/1277-steril (Friedt)	38
642	548/1812 (Friedt)	15
643	MRM 52 (Friedt)	31
644	Carina (Friedt)	33
646	224/1328 (Friedt)	23
647	302/1807-f (Friedt)	17
648	302/1807-12 (Friedt)	20
649	302/1807-223 (Friedt)	19
650	592/1939-15 (Friedt)	28
651	681/1682-4 (Friedt)	18
	six-rowed (mz)	
653	York (Reinbergs) mz [2]	23
654	OAC 21 X Brant 387 (Reinbergs) mz	24
655	OAC 21 X Brant 732 (Reinbergs) mz	24
656	Brant 387 X Brant 732 (Reinbergs) mz	24
657	Brant 387 X Brant 732 (Reinbergs) mz	25
660	F_7-Bulk (Reinbergs) mz	21
661	F_8-Bulk (Reinbergs) mz	22
	two-rowed	
662	PGR 8480 (Fedak)	14
663	Mutina (Friedt)	22
664	Aramir (Friedt)	24
665	2-1 (Ahokas)	34
667	Dissa (Friedt)	19
668	MGH 1998 (Friedt)	24
671	Doppelhaploide aus (Trumpf X VM 260) (Foroughi-Wehr)	19

C. Tetraploid selected strains (2n=4x=28) - two-rowed

Field No. 1981	Name/Number of Cultivar/Strain	Grain Yield (dt/ha)
6032	F_{13} Kreuzung Nr. 74	34.9[3]
6136	F_{9} Kreuzung Nr.138	28.5

3) Mean value of 5 plots, 10 m^2 each

In a separate experiment, the yield performance of several tetraploid and diploid stocks was compared more accurately; the results are presented in Table 2. As a rule, the yield of autotetraploids is less than half that of corresponding diploid parents. This immense yield reduction is mainly due to the partial sterility but also to the reduced tillering of autotetraploids as compared to parental diploids (Friedt, 1978). In a long-term breeding programme it was tried to improve fertility and vigour of tetraploid barley. This was partially successful with regard to fertility (Friedt, 1978). However, tetraploid stocks selected for high fertility after repeated mutagenic treatment and multiple hybridization still show approximately the same yield as the original autotetraploids (see end of Table 1, Nos. 6032, 6136).

Table 2. Yield performance of autotetraploid and corresponding diploid stocks of spring barley, Grünbach 1981.

Stock	Ploidy level	Grain yield 1)	
		dt/ha	%
Amsel	2x	64	100
	4x	23	36
Emir	2x	59	100
	4x	15	25
Haisa II	2x	62	100
	4x	28	45
Malteria Heda	2x	50	100
mutant C.20	4x	16	32

1) Plot size 10 m^2, 1 replication

References:

Friedt, W. 1978. Untersuchungen an autotetraploiden Gersten unter besonderer Berücksichtigung der Diploidisierung. I. Fertilität, Vitalität und Kornertrag. (Investigations in autotetraploid barley with special reference to its diploidisation. I. Fertility, vigour and kernel yield). Z. Pflanzenzuchtg. 81:118-139.

Friedt, W. 1981. Autotetraploids. (Coordinator's report) BGN 11:90-95.