

Characteristics of spring barley varieties for organic farming

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Background

Modern spring barley varieties are developed with the aim of combining high productivity and standardised product quality under high-input conditions using pesticides for control of weeds, diseases and insects as well as heavy application of nutrient-rich and water-soluble inorganic fertilizers. In the organic growing system, biotic and abiotic stresses have to be overcome by growing appropriate varieties (including variety mixtures etc.) and by practicing good farm management based on detailed knowledge of the biological processes going on during the crop development.

An important question is whether modern spring barley varieties possess the right combinations of characteristics such as disease resistance, weed competitiveness and nutrient uptake efficiency to ensure a stable and acceptable yield of good quality when grown under different organic growing conditions. A further question is in which way genetic diversity may contribute to ensure this.

We know that varieties often perform and yield differently in different environments due to genotype-environment interactions, so it may be important to evaluate characteristics of varieties in organic as well as in conventional farming systems. However, it remains unclear to date whether the differences between the conventional and the organic growing systems are large enough to justify breeding and testing of varieties in both environments.

The aim of a newly started inter-institutional Danish research project within The Danish Research Center for Organic Farming (DARCOF) is to investigate these questions. The project is organised as indicated to the right. Results from the first year of field trials are shown in Table 1, Fig. 1 and Fig. 2. The trials were at three locations (Flakkebjerg, Foulum and Jyndevad) with a conventional (Conv.) without fungicide treatment and/or an (or two) organic (Org.) growing system(s). Further information can be found on

<http://www.planteinfo.dk/obspareceller/foj2002.html>
<http://www.darcof.dk/research/darcofi/vi2.html>

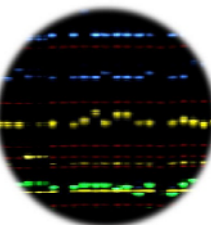
Table 1. Yields of the best 45 varieties and mixtures among 123 tested. Varieties are ranked within each trial (column). The yield (hkg/ha) of the standard variety is given for each trial for comparison (in red). Variety mixtures are indicated in blue.

(Deneken G, Willas J)

Conv. Flakkebjerg	Org. Flakkebjerg	Conv. Foulum	Org. Foulum
111 Br 5924c	113 Frontier	113 Simba	117 Simba
108 SJ 5519	111 Power	108 ASB 00-4	115 Br 5924c
107 LP 1124.1.99	111 Justina	108 Landora	110 Brazil
105 SJ 5508	110 Eunova	106 SJ 5519	110 SJ 5519
102 Justina	110 CSBC 1849-2	108 Hendrix	110 LP 1124.1.99
102 NFC 401-11	110 Landora	106 Eunova	109 Mix. 1
102 Mix. 4	107 Br 5924c	105 Mix. 1	108 Hellum
102 Hellum	107 Perdita	104 SW 2496	108 Justina
102 ASB 00-4	107 Philadelphia	103 SW 2533	108 Landora
101 CB 0148	107 Philadelphia	103 CSBC 1849-2	107 Alexandra
101 Breun 6336 A2	107 NFC 401-11	103 BR 6429c233	107 Dialoq
100 Br 6429c233	106 BR 6429c233	103 Br 6429c233	107 SJ 5508
58.7 Standard	108 Orthea	103 Dialoq	108 Faustina
99 Danuta	102 A 1481	102 CB 0148	106 Oira
100 Astoria	106 Sebastian	102 Br 5924c	106 Theford
99 SW Fialar	106 Recept	102 Perdita	105 Harriot
99 Power	106 Mix. 1	102 Hellum	105 CSBC 1849-2
99 Dialoq	105 SJ 5519	102 LP 1124.1.99	105 Breun 6336 A2
99 Jacinta	104 CSBC 1050-8-5	101 Frontier	104 Adonis
99 BR 6429c233	103 Mix. 5	101 Orthea	104 Eunova
99 SW Marietta	103 Mix. 2	101 Theford	104 Mix. 4
98 Danuta	103 Global	101 Class	104 ASB 00-4
98 CSBC 1849-2	103 Celebra	100 SW 2533	104 Hendrix
98 Sebastian	103 Theford	54.9 Standard	104 Mix. 5
98 Vortex	102 CB 0148	106 Breun 6336 A2	103 Annabell
98 Mix. 5	102 SW 2496	100 NFC 401-11	103 Frontier
98 Annabell	102 Cicero	100 Oira	103 SW 2496
98 Adonis	102 LP 1124.1.99	99 Mix. 4	103 BR 6429c233
97 Global	102 Scarlett	99 Adonis	103 Danuta
97 Nerdia	102 SW 2522	99 Brazil	103 Orthea
97 SW 2533	102 Hendrix	98 W 97-6 E	102 Hydrogen
97 Harriot	102 Harriot	98 Hydrogen	102 Mellan
97 Recept	102 Oira	98 CSBA 3464-10	102 SW Marietta
97 W 97-6 E	101 Adonis	98 SW Welter	102 Vortex
97 SW Welter	101 Hellum	97 Prestige	101 NFC 401-11
96 Hendrix	101 Nerdia	97 SW Moqui	101 Global
96 Mix. 1	101 SJ 5508	97 Braemar	101 CB 0148
96 SW 2522	101 Mellan	97 Faustina	101 Class
96 Brazil	101 SJ 7157	97 Global	101 CSBC 1050-8-5
96 Oira	101 Taster	97 Harriot	100 Nerdia
96 A 1481	100 PF 17048-52	97 SW Marietta	100 Sebastian
96 Landora	52.4 Standard	97 A 1481	100 Celebra
96 Eunova	100 Breun 6336 A2	97 SW Immer	100 CSBA 3464-10
95 LP 950.9.98	100 SW Marietta	96 CSBC 1050-8-5	56.1 Standard
11 LSD	11 LSD	8 LSD	4 LSD

Disease complexes:

Investigate competition between scald and netblotch

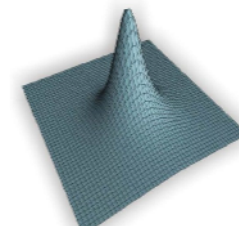


Molecular markers:

Identify varieties and perform association mapping

Variety trials:

Evaluate variety performance under conventional and organic farming methods



Statistics and mathematics:

Develop genotype-environment analyses and epidemiological models



Weeds:

Develop variety index for weed competitiveness



Plant Nutrition:

Evaluate nutrient uptake efficiency of varieties and mixtures

Variety mixtures:

Evaluate mixture effects on yield in interaction with diseases, weeds and nutrition

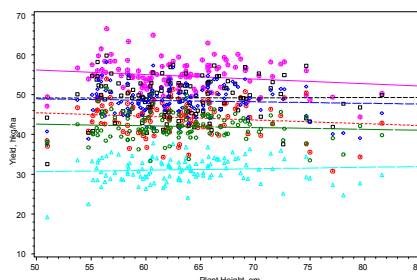


Fig. 1 Correlation between yield of cultivars and plant height. Each point is the average over replicates for each variety/variety mixture in each trial. When cultivars are grown conventionally, high plants are slightly disadvantageous (negative slope). This is not the case when the varieties are grown under organic growing conditions. The slopes are significantly different. As there is much variation around the lines, height is not sufficient to explain the variation in yield.

(Kristensen K, Willas J, Deneken G)

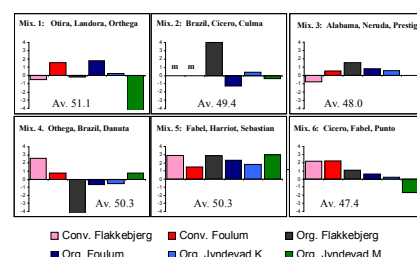


Fig. 2 Mixture effects (deviation from mean of the three components) on yield (hkg/ha) for each of six variety mixtures grown together with their components in the six trials. The average yield is indicated on the graph for each mixture. Only for Mix. 5, the overall mixture effect is significantly greater than zero. For Mix. 1, the mixture yields better than any of the components on Org. Foulum (see also Table 1).

(Østergård H, Kristensen K, Willas J and Deneken G)

Project members

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