Hulless Barley Variety 'Kornelija' – Development of Grain Production Technologies and Testing Results under CONVENTIONAL Farming Conditions in 2019

In order to facilitate the commercialization of the registered variety and to recommend the variety as a high-quality raw material for the production of functional foods, it is important to clarify its cultivation technology and processing capabilities and to evaluate the stability of its characteristics in a practical production environment.

Industrial research GOAL: To acquire new knowledge and to implement technological development for conventional farming conditions by specifying the agro-technical measures of the hulless barley variety 'Kornelija' for optimal yield, higher grain quality and reduction of cultivation risks by balancing the production costs (seed rate, fertilizer rate, fertilization regime).

METHODOLOGY

Sowing: April 18 Heading: June15 Maturity: July 25; Harvesting: July 29

Field trial in the CONVENTIONAL FARMING SYSTEM set up at the Institute of Agricultural Resources and Economics Stende Research Centre. Field area 20 m^2, 4 replications. 15 different variants are established with different agro technical elements - sowing rate, fertilizer rate, fertilisation regime, application of plant protection products:

- fertilisation regime based on agrochemical analysis of soil and planned grain yield:

Planned yield, t ha^{-1}	**Time of fertiliser application**	**Nutrients in pure form**			
		N	**P**	**K**	**S**
3.0	1 x: before sowing	53	20	30	13
4.0	1 x: before sowing	72	30	45	17
5.0	2 x: before sowing and in the shooting phase	91	40	60	22

- 3 sowing rates: 400, 450 and 500 germinating seed per m^2.

- Variants without the use of plant protection products/PPP; fungicide / F Variano Xpro1.0 L ha^{-1} and retardant/R Moddus 250 EC 0.4 L ha^{-1}).

RESULTS

Effect of sowing rate, fertilization rate and AAL application on grain yield, t ha^{-1}

Table 1

Planned yield, t ha^{-1}, without application of AAL	Seeding rate, seeds / m2			AVERAGE YIELD
	350	400	450	
3.0	4.03	4.25	4.27	**4.18**
4.0	4.29	4.25	4.35	**4.29**
5.0	4.43	4.33	4.48	**4.41***
AVERAGE	**4.25**	**4.28**	**4.37**	

Table 2

Planned yield, t ha^{-1}	Use of plant protection products / Application of AAL	Seeding rate, seeds / m^2			AVERAGE YIELD
		350	400	450	
4.0	**w/o AAL**	4.29	4.25	4.35	**4.29**
	with AAL	5.16	5.13	5.20	**5.16***
5.0	**w/o AAL**	4.43	4.33	4.48	**4.41**
	with AAL	5.43	5.40	5.61	**5.48***
AVERAGE		**4.83**	**4.78**	**4.91**	

CONCLUSIONS – grain yield

- ✓ The variety 'Kornelija' cultivated without application of plant protection products, with a lower nitrogen fertilizer rate (N53) already yielded **grain yields** above 4.0 t ha^{-1}. While mineral nitrogen fertilizer rate N72 did not provide significant yield increase. The variety with the increased and split fertiliser dose did not reach the planned grain yield of 5 t ha^{-1} (see Table 1).
- ✓ Variety 'Kornelija' cultivated with application of plant protection products provided grain yield higher than 5 t ha^{-1} already with applied mineral nitrogen fertiliser rate N72. The highest grain yield of 5.48 t ha^{-1} in the field experiment obtained with elevated and splitted mineral fertiliser N dose (N91) (see Table 2).
- ✓ Variation with different sowing rates in 2019 did not show the significant difference in grain yield in any of the fertiliser variants. Comparatively better results were obtained at the highest seeding rate 450 germinating seeds/m^2.

Effect of seed rate, fertiliser rate and application of plant protection products on grain quality***

Table 3

Variants Planned Yield / Seed Rate	Disease resistance, 0-4 points				Lodging-resistance 1-9 points**
	Mildew	Pyrenophora teres	Septoriosis	Rust	
3t/350	2.5	2.0	2.0	2.0	7.3
3t/400	2.5	2.0	2.0	2.5	7.0
3t/450	2.5	2.0	2.0	2.5	8.0
4t/350	2.0	2.0	2.0	2.0	7.3
4t/400	3.0	2.0	2.0	1.5	7.5
4t/450	2.5	2.0	2.0	1.5	8.0
5t/350	2.5	2.0	2.0	2.0	6.0
5t/400	2.0	2.0	2.0	2.0	5.8
5t/450	2.5	2.0	2.0	2.0	6.5
4t/350+FR	0	0.5	0	0	9.0
4t/400+FR	0.5	0	0	0.5	9.0
4t/450+FR	0	0	0	0.5	9.0
5t/350+FR	0	0	0	0	8.5
5t/400+FR	0	0	0	0	7.3
5t/450+FR	0	1	0	0	7.8

Effect of seed rate, fertiliser rate and PPP application on disease and lodging resistance

Table 4

Variants Planned Yield / Seed Rate	1000 grain weight / TGW g	Test weight, g L^{-1}	Protein, %	*β-glucans %*	*Starch %*
3t/350	47.7	815.6	16.4	4.9	59.8
3t/400	48.2	815.0	16.1	4.9	60.2
3t/450	48.8	816.8	16.3	4.9	60.0
4t/350	49.6	817.6	16.5	4.8	59.7
4t/400	48.2	819.5	16.2	4.7	60.0
4t/450	48.0	812.2	16.6	4.8	59.7
5t/350	47.9	815.2	17.0	4.9	59.4
5t/400	47.3	809.8	17.4	4.8	59.0
5t/450	48.6	814.8	17.4	4.8	59.2
4t/350+FR	49.1	814.1	17.5	4.8	59.0
4t/400+FR	49.3	817.9	17.0	4.9	59.3
4t/450+FR	49.0	822.0	16.8	4.7	59.7
5t/350+FR	50.8	818.1	16.5	4.8	59.3
5t/400+FR	51.3	831.4	16.3	4.9	59.6
5t/450+FR	50.9	828.2	16.1	4.7	59.9
Average	**49.0**	**817.88**	**16.7**	**4.8**	**59.6**
p	*p<0.01*	*p<0.01*	*p<0.01*	*p>0.05*	*p<0.01*
Rs0.05	*1.809*	*9.05*	*0.542*	*0.194*	*0.681*

* 0 - no signs of disease; 4 - low disease-resistance; ** 9 – no lodging; 1 - fully lodged; *** Protein, beta-glucans and starch were determined by *Infratec NOVA*

CONCLUSIONS – disease and lodging resistance	*CONCLUSIONS – grain quality*
❖ In 2019 which was considered to be favourable for the development of diseases, the hulless barley variety 'Kornelija' in the variants without fungicidal application showed moderate **disease-resistance** (Table 3). ❖ Fungicide use has been comparatively effective in limiting the spread of disease in the crop, providing significant yield increase (see Table 2). ❖ The variety **lodging-resistance** between agro technical variants ranged from 6.0 points (medium resistance) to 9.0 points (very high lodging resistance) (Table 3). ❖ Comparing applications WITHOUT and WITH retardant Moddus 250EC has an average 1.6 points increase of variety lodging-resistance. ❖ The use of plant growth regulator should only be recommended for technological variants with heightened N fertiliser rates	❖ Trial Results 2019 have confirmed that variety 'Kornelija' has coarse grains (average TGW 49.0 g), high test weight (817.8 g L^{-1}), crude protein (16.7%) and β-glucans (4.8%). ❖ Significantly higher TGW and test weight were obtained in sowing variants with application of plant protection products/PPP. The variation in the physical characteristics of these grains was not significantly affected by the sowing rate. ❖ Significantly higher protein content was found in grains cultivated with elevated and splitted doses of mineral N (N91) without the application of PPP. ❖ The content of β-glucans in the grain has not changed significantly due to different seed rates and fertilisation options. ❖ The higher the crude protein content of the grain, the lower the starch content. Grains with higher test weight have relatively lower protein content.

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