IMPACT OF SOWING DIRECTION TOWARDS CARDINAL POINTS ON CROP YIELD

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Introduction – Úvod

In some former manuals of planting, it was recommended that sowing should be performed in the direction North-South. As justification, it was said that such direction of sowing allows for higher crop yield, especially concerning barley and rye, by 1.0 – 2.0 on ha in comparison to crop yield from sowing in the direction East-West. Considering present level of crop yield this difference would amount to 10% - 15%. Such direction of sowing was also recommended due to its beneficial impact on the protein and starch content in the grain. Kostin [1] explains the higher crop yield of winter rye achieved from sowing in the direction North-South with greater consumption of solar energy. Literature also offers other, although sporadic, reports on the impact of sowing direction on crop yield and chemical composition of plants.

The objective of the studied commenced in 1990 at the Department of Plant Production was to define the impact of the sowing direction towards cardinal points on the crop architecture, assimilation surface of leaves, the grain yield and protein content in grains. In total, six series of careful field experiments were conducted with various species and varieties of spring and winter crops. Some results of these studies have been presented in this article.

Results of the studies

In the years 1991-1994, two field experiments were performed concerning the impact of sowing direction on crop yield of spring triticale. During the experiment conducted on the soil of very good wheat complex near Cracow the impact of sowing direction was studied on crop yield of two varieties of spring triticale: Jago and Maja.

Results of this experiments showed that the direction of sowing had significant impact on the grain crop yield and the protein content in the grain (Table 1). The crop yield of triticale grain in crops seeded in the direction North-South was higher on average by 0.48 t per ha in comparison with the crop yield of seeding in the direction East-West. Protein content in the grain in items seeded in the direction North-South was on average higher by 0.32%.

The experiment conducted in mountain conditions did not show any significant impact of sowing direction on the triticale crop yield (Table 2). A tendency was observed, however, of higher grain yield in items seeded in the direction North-South. These studied proved a significant impact of sowing direction on protein content in the grain. The North-South direction of sowing was more beneficial, and the protein content in the grain was higher by 0.24-1.18% depending on the variety and cultivation technology. In both experiments, plants seeded in the direction North-South featured larger leaf surface and higher LAI index (ratio of leaf surface to soil surface).

Another experiment studying the impact of sowing direction on crop yield of six varieties of spring crops no significant impact on crop yield was observed (Table 3).

Sowing direction North-South had beneficial impact on protein content in the grain, which was higher for this direction on average by 0.08-0.84% depending on the variety as compared with protein content in items seeded in the direction East-West.

In the years 1993-1996, studies were conducted on the impact of sowing direction towards cardinal points on leaf surface and crop yield of various species of winter crops cultivated in two technologies: extensive and intensive (Table 4). The experiment did not show any significant impact on grain yield, yet the crop yield on items seeded in the direction North-South was slightly higher. However, the protein content in the gain of all varieties seeded in the direction North-South was significantly higher.

Conclusions and recommendations

Seeding in the direction North-South is more beneficial as it creates opportunities for achieving higher grain yield.

Protein content in the grain of crops seeded in the direction North-South is higher.

Higher grain yield and the higher protein content in crops seeded in the direction North-South in most cases is related to the greater assimilation surface of leaves and the higher LAI index of leaf number (ratio of leaf surface to soil surface).

If the shape of the field allows to do so, it is recommended that the crops be seeded in the direction North-South or similar.

Literature

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Table 1. Impact of sowing direction on the assimilation surface of leaves, crop yield and protein content in the grain of spring triticale – lowland conditions (average of three years, Szmigiel 1997a)

Sowing direction	Variety	Leaf surface (cm3)		LAI index		Grain yield (t/ha)	Protein % in grain
		Blade shoot-ing	earing	Blade shoot-ing	earing		
North-South	Jago	159	211	3.58	4.72	6.47	15.16
	Maja	180	235	3.51	4.22	6.65	15.41
East-West	Jago	147	214	3.50	4.37	6.04	14.86
	Maja	174	217	3.45	4.08	6.12	15.07
NIR(p=0.05) for sowing direction						0.296	0.276
variety						-	-

Table 2. Impact of sowing direction on the assimilation surface of leaves, crop yield and protein content in the grain of spring triticale – mountain conditions (average of three years, Szmigiel 1997a)

Sowing direction	Cultivation technology	Variety	Leaf surface (cm3)		LAI index		Grain yield (t/ha)	Protein % in grain
			Blade shooting	earing	Blade shooting	earing		
North-South	standard	Jago	123	148	2.97	3.62	3.45	13.72
		Maja	104	109	3.52	3.80	3.61	14.11
	Condensed seeding + retardant	Jago	119	144	3.52	3.26	3.36	13.46
		Maja	110	117	3.48	3.64	3.76	13.76
East-West	standard	Jago	124	145	3.01	3.31	3.14	13.48
		Maja	92	109	3.35	3.34	3.45	12.93
	Condensed seeding + retardant	Jago	126	140	3.34	3.42	3.17	12.93
		Maja	115	107	3.28	3.53	3.64	13.36
$NIR_{(p=0.05)}$ for sowing direction							-	0.317
Variety							0.268	0.276
Cultivation technology							-	0.258

Table 3. Impact of sowing direction on crop yield of six varieties of spring crops (t/ha) and protein content in the grain (%). (Szmigiel 1997b)

Species	Variety	North-South		East-West	
		Grain yield t/ha	Protein content %	Grain yield t/ha	Protein content %
Barley	Ars	6.21	14.5	5.78	13.66
	Lot	6.53	13.84	6.69	13.76
Wheat	Henika	7.30	14.10	6.75	13.96
	Broma	6.86	14.03	6.82	13.67
Oat	Koral	7.02	15.17	6.75	14.74
	Farys	7.20	14.65	6.90	14.26
Average:		6.85	14.38	6.61	14.01
$NIR_{(p=0.05)}$ for:					
species		-	0.147		
sowing direction		0.280	0.229		
technology		0.411	0.295		

Table 4. Impact of sowing direction on leaf surface and crop yield of winter crops (Szmigiel 1998)

Species	Cultiva-tion techno-logy	North-South			East-West		
		Grain yield, t/ha	Protein con-tent %	LAI	Grain yield t/ha	Protein con-tent %	LAI
Winter wheat	A	5.39	12.06	2.63	5.33	11.54	2.70
	B	6.55	13.38	3.62	6.28	12.83	3.46
Winter barley	A	3.74	11.43	2.44	3.76	11.17	2.51
	B	4.94	13.11	2.97	4.82	12.18	2.80
Winter triticale	A	5.25	10.02	3.97	5.03	9.65	3.66
	B	6.28	11.99	4.46	5.40	11.73	4.31
$NIR_{(p=0.05)}$ for:							
species		0.336	0.394				
sowing direction		-	0.344				
technology		0.283	0.372				

A - extensive technology; B - intensive technology