Impact of cultivation technology on yield and fodder value of winter triticale grain

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Abstract. In 2008-2010 grain yield and fodder value of winter triticale cv. Kitaro were assessed. The level of plant protection covered three technologies with various production intensity. Grain yield of winter triticale cultivated on the higher agro technical level was 7,56 t/ha and was respectively almost 36% higher than the yield obtained from standard technology. The intensity of plant protection agents application influenced the increase of protein and fat content but decreased the content of crude fibre and sugar.

Keywords: fodder value, cultivation intensity, grain yield, winter triticale.

1 Introduction

For many years we have seen a growth in the share of cereals in the crop structure. They occupy over 70% of the acreage of crops. In some areas even up to 90%. This large saturation rotation poses a problem of ensuring appropriate positions on the farmland. This causes a number of environmental changes leading to reducing yields. Triticale has a greater tolerance to weak soil conditions, a high yield potential in comparison with wheat. It is also characterized by a high value of feed grains (Jaśkiewicz et al. 2008, Smagacz and Dworakowski 2004, Stankiewicz 2005).
Therefore, triticale harvest is almost entirely used for animal feed. The value of feed of triticale grain in animal nutrition is determined by the nutrients it contains, high digestibility and biological value of protein.
Studies show that the quality of triticale grain does not only depend on the variety, but also on other elements of technology such as sowing, fertilizing and applying pesticides.
There are no conclusive research results on the impact of technology on the quality of the grain of triticale (Grabinski et al. 2008, Stanley et al. 2002, Stanley 2005, Kiely et al. 2009).
The aim of the study was to determine the yield of Kitaro winter triticale and a laboratory evaluation of grain quality depending on cultivation technologies.

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2 Materials and Methods

The study was conducted in 2008-2010 within the strict field experiments at the Experimental Station of the Institute of Soil Science and Plant -National Research. Institute in Osiny under cereal crop rotation (100% grain) in the soil of good wheat complex.
The study involved three techniques differing in the intensity of production, which was determined primarily by the use of differentiated means of production. A factor which clearly differentiated technologies was the level of plant protection (Table 1). In all the technologies, Kitaro variety was grown,. The study was conducted on plots with a harvesting area of 22m^2.

Table 1. Consumption of seed, fertilisers, and pesticides in the winter triticale cultivation technologies.

Technology element	Technology		
	Standard	Integrated	Intensive
Seeds kg/ha	205	180	156
Fertilisers kg/ha:			
N	55	108	141
P_2O_5	35	64	90
K_2O	50	90	135
Herbicides	Glean 75 WG 25g/ha	Maraton 375 SC 4 l/ha Starane 0,5 l/ha	Maraton 375SC 4 l/ha Starane 0,5 l/ha
Fungicides	Baytan Universal 200 ml + Galmano 200 ml/100 kg seeds	Baytan Universal 200 ml + Galmano 200 ml/100 kg seeds Tilt Plus 1,0 l/ha +Unix 0,7 l/ha	Baytan Universal 200 ml + Galmano 200 ml/100kg seeds Tilt Plus 1,0 l/ha +Unix 0,7 l/ha Prosaro 1,0 l/ha
Retardants	-	CCC 1,0 l/ha	CCC 1,0 l/ha Moddus 0,3 l/ha

In the phase of full maturity, the yield of winter triticale was determined, and grain samples were taken for the implementation of the laboratory determinations. Dry matter content was determined by a weight method at a temperature of 105^{o}C. Then, in the process of mineralization of samples by a wet method (H_2SO4 + perhydrol) nitrogen was determined by a spectrophotometry flow, crude fiber by a weight method, sugars by G.
Bertrand method, crude fat by weight method by Soxhlet - and ash by weight method at a temperature of 580 ^{o}C.

The obtained results were statistically analyzed using analysis of variance. The significance of differences in the results was determined using Tukey's test with confidence level P = 0.95

3 Results and discussion

Technologies of plant cultivation modified the level of crop yield and nutritional value of the grain of Kitaro winter triticale (Table 2).
A significantly highest grain yield of winter triticale was obtained using intensive technology. The yield was about 36 and 11% higher than the yield of triticale obtained with respectively standard technologies and integrated technologies. Intensive technology was characterized by a high-dose and an intensive plant protection. It also involved a substantially reduced standard of seeding.
A significant impact of the intensity of the production on increasing yield of triticale is confirmed by the research by Wozniak (1999). Fungicides used against stem and leaf diseases increased grain yield by 6.6%. However it must be concluded that a lower standard of triticale seed at intensive technology has contributed to an improvement in propagation production and increased the number of ears per area unit. It is confirmed by the studies of Jaskiewicz (2009).
In the applied technologies, there was not a significant difference in the percentage of dry matter and ash in the grain crops.
Protein constitutes an important component of the food grain. Triticale is a species with a relatively high content of this component. Significantly lower protein content in grain was found when using a standard technology. Increasing the intensity of cultivation contributed to an increase in the value of this ratio by 4% for integrated technology and 14% for the intensive one.
The research of Piech and Maciorowski (1998), and Stankiewicz et al. (2002) indicate that winter triticale grain contains more protein using plant care with herbicides compared with the grain derived from plots without a care. However, according to Stankiewicz et al. (2002), the use of retardants reduces protein yield but improves the digestibility index.

The content of crude fiber in the grain of Kitaro triticale was 12% higher for standard technology compared to intensive technology. Together with an increase of the intensity of plant protection, a decrease in the content of crude fiber and sugar was observed. On the other hand, there was an increase in the content of fat in the grain of triticale.
To conclude, it should be noted that the purpose of research was carried out because we can now recommend for practice an intensive technology of triticale Kitaro, at which the highest yield with advantageous features of feed was obtained.
Higher contents of protein and fat were obtained. Lower crude fiber content in the grain determines a better quality of forage triticale, obtained using this technology

Table 2. Winter triticale grain yield and fodder value of feed depending on the cultivation intensity

Technology	Grain yield (t)	Dry matter	Crude protein	Crude fibre	Sugars	Fat	Ash

				(% s.m.- d.m.)			
standard	5,56	91,8	10,7	1,76	10,54	1,68	1,87
integrated	6,81	91,5	11,1	1,63	10,22	1,74	1,85
intensive	7,56	91,7	12,2	1,57	9,79	1,81	1,89
$NIR_{0,95}$	0,651	r.n	0,34	0,123	0,564	0,092	r.n
$LSD_{0,95}$							

4 Conclusions

1. Cultivation technology of Ttriticale had a significant impact on the obtained grain yield per unit area. The highest yield was obtained when using an intensive one, then integrated, and the lowest – when standard technology was applied.
2. Intensive technology has contributed to an increase in the content of protein and fat, however the contents of crude fiber and sugar decreased.
3. Higher value of feed grains was obtained using intensive technology of triticale production, and lowest at the application of standard technologies.

5. Reference List

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