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EFFICIENCY OF PLANT EXTRACTS (*HERBIPLANT CS*) IN PIGS FATTENING

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The aim of the investigation was to determine the effect of a plant extracts mixture (*Herbiplant CS*) used as a feed supplement on fattener's performance, carcass value and back fat quality. The preparation was made at the Research-Promoting Centre LNB Poland Ltd. in Kiszkowo and it was standardized with respect to the bioactive substances concentration. *Herbiplant CS* phytopreparation was applied in the form of loose powder to feed mixtures of a *starter, grower* and *finisher* type in the amount of 125 and 500 mg/kg (3 groups of fatteners). The animals were kept individually and fattened from 20 to 100 kg of body weight.

An average daily live weight gain in control group within the whole period of fattening reached 896 g, and in the groups supplemented with *Herbiplant CS* was higher of 3.8 and 5.0%. An average daily feed intake by pigs in the subsequent stages of fattening was similar in all groups. Feed consumption per 1 kg of weight gain in the whole fattening period was 2.67 kg in control group, while in those supplemented with *Herbiplant CS* it was lower by 4.9 and 6.4%. An introduction of phytopreparation dose to feed mixtures had no effect on carcass meatiness and only the increase in loin "eye" was observed. The assessed phytopreparation did not significantly influence fatty acids profile. The contents of saturated (SFA), monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids were similar.

Phytopreparation *Herbiplant CS* at a dose of 500 mg per 1 kg of mixtures improved performance indicators more considerably in the first period of fattening, while the other periods featured similar efficiency compared *Herbiplant CS* doses (125 and 500 mg/kg).

INTRODUCTION

After the withdrawal of antibiotic growth promoters application as a feed additives for fatteners, the increased interest in other natural substitutes in the role of growth stimulants has been observed. As it was proved in research by certain authors [Grela *et al*., 1998; Janz *et al*., 2007; Lien *et al.*, 2007] the products that may replace feed antibiotics in pig feeding are biologically active substances obtained by an extraction of selected herbs. Main active substances originating from those plants include cinnamonaldehyde, cineol, carvacrol, thymol, capsaicin, eugenol, anethol, allicine and menthol. They possess especially strong effect on digestive enzymes activity [Kamel, 2000; Platel & Strimivasan, 1996]. Observed improvement in animals' state of health, more profitable nutrients conversion, as well as increased body weight gain may be attributed to the mentioned influence [Grela *et al*., 2000ab; Hańczakowska & Urbańczyk, 2002; Korniewicz, 2004].

The improvement of performance indicators depends mainly on the appropriate composition of biologically active substances obtained from different herbs, applied technology, doses and kind of feed used in fatteners feeding [Park *et al*., 2000; Paschma & Wawrzyński, 2003; Namkung *et al*., 2004; Maass *et. al*., 2005].

Beneficial influence of *Herbiplant CS* on a digestibility of main nutrients and nitrogen retention was demonstrated in a previous research [Korniewicz *et al*. 2007a]. In another study, the authors [Korniewicz *et al*. 2007b] observed a profitable influence of the preparation on lipid management what was proved by a decreased level of total cholesterol and its LDL fraction in blood serum.

The aim of the investigation was to determine the effect of plant extracts (*Herbiplant CS*) on fatteners body weight gain, feed intake, carcass traits and fatty acid composition of back fat.

MATERIAL AND METHODS

The experiment enabled the assessment of plant-originating substances mixture originating mainly from phytoncides ones, that possess fungistatic, anti-inflammatory, fungicidal and protozoicidal properties [Korniewicz & Różański, 2006]. *Herbiplant CS* phytoprepatarion was made out in Research-Promoting Centre LNB Poland Ltd. It consists of micronized plant parts, essential oils and plant extract mixture sedimented on silica and stabilized with palm oil. The preparation is standardized regarding the content of the following main active plant-originating substances (in mg/kg): thymol – 38,500; 1.8 cineol – 35,000; carvacrol – 10,000; pinen – 4000, capsaicin – 1700; cinnamon aldehyde – 975; eugenol – 450; flavonides – 6000; and essential oils – 97,000.

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Herbiplant CS preparation, in the form of loose powder, was used as premixes component of a *starter*, *grower* and *finisher* type mixtures, administered in the amount of 0.5% to feed mixtures. Wheat bran served as premixes carrier. Three kinds of feed mixtures of the same feed ingredients, differing only in *Herbiplantu CS* supplement amount used in premixes, were produced. Therefore, three nutritional groups were created regarding different quantity of plant extract supplement: Group I – control, Group II – feed mixture with plant extract (*Herbiplant CS* – 125 mg/kg), and Group III – feed mixture with plant extract (*Herbiplant CS* – 500 mg/kg).

Three-stage experimental fattening was conducted from 20 up to 100 kg body weight. Three kinds of feed mixtures adjusted to each fattening stage were introduced: *starter* type – the first stage of fattening (24 days), *grower* type – the second stage of fattening (26 days), and *finisher* type – the third stage of fattening (35 days)

Feed ingredients used for feed mixtures production were subject to chemical analysis using the methods in force [AOAC, 1990]. On the basis of the analysis, the basic content of nutrients and mineral components in mixtures was determined. Energy value was calculated based on own analysis of components and digestibility coefficient, as well as the formulas included in Polish Pig Feeding Standards [1993] and CVB [2004].

Percentage composition of *starter*, *grower* and *finisher* type feed mixtures, and nutrients content are presented in Table 1. Feed mixture of *starter* type administered to weaned piglets for the first 24 days of feeding contained 17.7% of crude protein, 1.18% of total lysine, 0.69% of methionine + cystine, 0.76% of threonine, and 0.21% of tryptophan (Table 1). In the second stage of fattening, lasting 26 days, *grower* type feed mixtures were used. They contained 16.4% of crude protein, 1.01% of total lysine, 0.60% of methionine with cystine, 0.64% of threonine, and 0.20% of tryptophan. In the third stage of fattening lasting 35 days, *finisher* type feed mixtures including 15.6% of crude protein, 0.90% of total lysine, 0.59% of methionine with cystine, 0.59% of threonine and 0.19% of tryptophan was applied. Comparing to *starter* type mixtures, *grower* and *finisher* type ones had a lowered content of mineral components. The decrease in protein, amino acids and mineral components content in *grower* and *finisher* type mixtures in relation to *starter* type is a result of physiological needs of animals and is consistent with the recommendations included in Polish (1993) and Dutch (2004) pig feeding standards, and with the pig feeding programme by LNB Poland Sp. Ltd. worked out by Korniewicz [2006].

Energy value of the mixtures applied in subsequent stages of fattening was similar and ranged 2280-2260-2250 kcal/kg (net energy).

Feed mixtures produced in a ground form were subjected to biological assessment on young pigs in order to determine performance efficiency. The research was carried out at the Animal Nutrition Experimental Farm in Gorzyń (Agricultural University in Poznań).

The research material consisted of 27 weaned piglets [sow (Polish large white x Polish landrace) x boar (Hampshire x Pietrain)] of initial body weight of about 20 kg, randomly divided into 3 nutritional groups, each consisting of 9 animals (replicates). All animals were kept individually in pens equipped with pig's feeders and nipple drinkers.

TABLE 1. Percentage composition and feeding value of mixtures for fatteners.

Ingredients	Units	Type of mixture		
		Starter	Grower	Finisher
Ground maize	%	30.00	-	-
Ground wheat	%	29.50	19.50	14.50
Ground barley	%	15.00	42.00	25.50
Ground triticale	%	-	20.00	40.00
Wheat bran	%	-	-	5.00
Soya bean oilmeal	%	20.50	15.00	12.00
Lonacid Max (1017) – Acidifier	%	0.50	-	-
Farmer premix:				
- Starter Herba Global Forte	%	4.00	–	–
- Grower/Finisher Herba Global Forte 3	%	–	3.00	2.50
Pre-mixture 1 or 2 or 3	%	0.50	0.50	0.50
Total	%	100.00	100.00	100.00
In 1 kg of mixture: Metabolizable energy	MJ	13.25	13.10	13.05
Net energy	kcal	2280	2260	2250
Crude protein	%	17.70	16.40	15.60
Crude fiber	%	2.73	3.38	3.35
Crude fat	%	2.42	2.03	2.04
Crude ash	%	5.32	4.71	4.32
Lysine	%	1.18	1.01	0.90
Methionine + Cystine	%	0.69	0.60	0.57
Threonine	%	0.76	0.64	0.59
Tryptophan	%	0.21	0.20	0.19
Isoleucine	%	0.70	0.63	0.59
Ca total	%	0.78	0.69	0.59
P total	%	0.63	0.52	0.53
P digestible	%	0.43	0.31	0.28
Na	%	0.19	0.17	0.15

Feed mixtures prepared for particular groups were administered *ad libitum* in pig feeders, registering feed intake. After 24, 50 and 85 days of feeding the individual body weight gain and feed intake were controlled. After 85 days of fattening, 8 fatteners (4 hogs and 4 gilts) were selected to be slaughtered and carcass traits were evaluated. The meatiness was determined with the use of GGM device (EUROP System). Collected back fat samples were subjected to analysis regarding fatty acids content in the Laboratory of Sea Fisheries Institute in Gdynia. The analysis were done according to chromatographic method [Shanta & Napolitano, 1992; PN-EN ISO 5508:1996] using gas chromatograph (Agilest Technologies 6890N) coupled with mass spectrometer (GC/MS by Varian Saturn 2000) with relation to a standard mix-

ture of 37 fatty acids. Chromatographic analysis of fatty acid were conducted after their appropriate methyl metrification [Breithaupt, 1994; PN-EN ISO 5509:2001]. Previously estrified, purified samples were subjected to analysis according to gas chromatography technology, applying FID detector and capillary column 100 m long, covered with SP-2560 phase. The mentioned method is used in research laboratory of SFI and follows elaborated research procedure.

The results were worked out statistically using analysis of variance and differences of mean values between the groups were assessed according to Duncan's multiple range test (Statgraphics 5.0. software).

RESULTS AND DISCUSSION

Results of fattening

Production results are presented in Tables 2 and 3. Body weight of weaned piglets at the beginning of the experiment was even in particular groups and reached 19.61–19.16–19.29 kg, respectively. Fattening results with respect to daily gains, feed intake and conversion were analysed separately for particular periods of fattening, as well as for the whole period of fattening.

An average daily gain in the case of control pigs in the first stage of fattening (24 days) was 841 g. Body weight gains in experimental groups in the same stage were higher by 2.1 and 4.0%.

Similar differences between nutritional groups and an average daily gain in control group up to 962 g were observed in the second period of fattening (26 days). Fatteners from II group (*Herbiplant CS* – 125 ppm) achieved gains higher by 2.4%, while fatteners from III group (*Herbiplant CS* – 500 ppm) by 3.8% as compared to the control group.

TABLE 2. Results of fattening.

Specification	Group (n = 9)		
	I Control	II Herbiplant CS 125 ppm	III Herbiplant CS 500 ppm
	Average body weights (kg)		
Initial	19.61	19.16	19.29
After 24 days of fattening	39.79	39.77	40.29
After 50 days of fattening	64.79	65.37	66.27
After 85 days of fattening	95.78[a]	98.18[b]	99.24[b]
	Average daily gains (g)		
I period (24 days)			
(g)	841[a]	859	875[b]
(%)	100.0	102.1	104.0
II period (26 days)			
(g)	962	985	999
(%)	100.0	102.4	103.8
III period (35 days)			
(g)	885[a]	937[b]	940[b]
(%)	100.0	105.9	106.2
Whole fattening period (85 days)			
(g)	896[a]	930[b]	941[b]
(%)	100.0	103.8	105.0

a,b – p≤0.05

In the third period of fattening (35 days) control fatteners were characterized by an average daily weight gain at the level of 885 g, and the values were lower comparing to the second stage of fattening. Similar decrease in body weight gains was observed in experimental groups, yet they were higher than those of the control one (p≤0.05). Daily body weight gains in control fatteners within the whole period of fattening reached 896 g, and should be regarded as satisfactory. *Herbiplant CS* feed supplement in amount of 125 and 500 ppm resulted in an increase in body weight gains by 3.8 and 5.0% (p≤0.05), respectively, comparing to the control group.

In an earlier study by Korniewicz [2004], plant extract in the amount of 200 g/t was supplemented to a feed mixture of fatteners. During the whole fattening period the increase in body weight gains of 8.0% was observed. In the experiment conduced in France [Kamel, 1999] pigs with body weight of 37 to 107 kg were given a feed mixture with plant extracts, Pig Grower XT, in the amount of 200 g/t. Fatteners from the control group obtained daily weight gains at a level of 834 g, while the experimental ones of 886 g (increase by 5.9%).

An average daily feed intake by fatteners in the subsequent stages of fattening and within the whole period of fattening was similar in all groups. Fatteners from experimental groups that were given the feed mixture supplemented with *Herbiplant CS*, consumed slightly less (1.3 and 1.7%) mixture than the control ones (2.39 kg), that could be attributed to feed flavour. Also in another research [Korniewicz, 2004] the effect

TABLE 3. Feed intake and feed conversion.

Specification	Group (n = 9)		
	I Control	II Herbiplant CS 125 ppm	III Herbiplant CS 500 ppm
	Daily feed intake (kg)		
I period (24 days)			
(kg)	1.75	1.72	1.67
(%)	100.0	98.3	95.4
II period (26 days)			
(kg)	2.60	2.65	2.58
(%)	100.0	101.9	99.2
III period (35 days)			
(kg)	2.67	2.62	2.65
(%)	100.0	98.1	99.2
Whole fattening period (85 days)			
(kg)	2.39	2.36	2.35
(%)	100.0	98.7	98.3
	Feed intake (kg) per 1 kg of weight gain		
I period (24 days)			
(kg)	2.08[a]	2.00	1.91[b]
(%)	100.0	96.1	91.8
II period (26 days)			
(kg)	2.71[a]	2.61	2.58[b]
(%)	100.0	96.3	95.2
III period (35 days)			
(kg)	3.02[a]	2.83[b]	2.81[b]
(%)	100.0	93.7	93.0
Whole fattening period (85 days)			
(kg)	2.67[a]	2.54	2.50[b]
(%)	100.0	95.1	93.6

a,b – p≤0.05

of plant extracts on fatteners daily feed intake (2.47 kg) within the fattening period from 25 to 100 kg was not observed.

Taking into consideration the differentiated body weight gains in particular nutritional groups, and similar feed intake it is possible to regard a feed intake per 1 kg of body weight gain as the best indicator. The results obtained proved that *Herbiplant CS* applied as feed supplement did affect the feed conversion. In the first stage of fattening the feed intake per 1 kg of body weight gain in pigs from the control group amounted to 2.08 kg. *Herbiplant CS* influenced the increase in that indicator value of 3.9 and 8.2%. The difference between the control and experimental group III (500 ppm) was confirmed statistically ($p \leq 0.05$).

In the second stage of fattening, the feed intake per 1 kg of body weight gain in the control group increased to 2.71 kg. The extracts supplemented in experimental groups influenced the better feed conversion by 3.7 and 4.8%.

In the third stage of fattening, the further increase in feed intake per 1 kg of body weight up to 3.02 kg in control group was observed. In that period, further favourable effect of the phytopreparation, resulting in better feed conversion by 6.3 and 7.0% ($p \leq 0.05$) was confirmed.

An average feed intake per 1 kg of body weight gain within the whole period of fattening reached 2.67 kg in I group, and a decrease of about 0.13 (4.9%) and 0.17 kg (6.4%) was observed in experimental groups.

Beneficial effect of plant extracts on feed conversion improvement in pigs was reported by other authors, for example Kamel (1999) or Korniewicz [2004]. In turn, Namkung *et al*. [2004] compared the efficacy of acids, antibiotic – lincomycine and plant extracts derived from cinnamon, thyme and oregano in piglets feeding. The used mixture of plant extracts and acids significantly influenced the reduction in a number of pathogenic coli bacteria, and did not reduce a very useful *lactobacillus* population at the same time. In contrast to these additives, lincomycine reduced both a profitable and undesirable bacterial flora. Park *et al*. [2000] gave a mixture of herbs in the amount of 0.4 and 0.8 g/1 kg of body weight/day to piglets. They proved a beneficial influence of this supplement on feed intake and body mass gain. In another research conducted by Li *et al*. [2006] 0.5, 1.0 and 1.5% of Chinese herb "*Shiquan Dabu*" was given in feed mixtures for fatteners. The authors demonstrated that the herb added to the feed significantly influenced the increase in body weight gain (7.4-12.8%), improvement of feed conversion (5.2-7.2%) and an increase in meat content in carcass and its better quality as well.

Improved feed conversion in fatteners receiving *Herbiplant CS*, especially at the dose of 500 mg/kg, resulted in a better digestibility of basic nutrients, and particularly in increased nitrogen retention. As it was proved in earlier studies [Korniewicz *et al.,* 2007a], pigs that were given *grower* type feed with *Herbiplant CS* supplement at a dose of 125 ppm excreted less nitrogen in faeces and urine. As a result, nitrogen retention in relation to its intake increased from 46.7 to 48.4%.

Carcass evaluation

The results of carcass post-slaughter evaluation are shown in Table 4. Pre-slauther body weight of pigs from all groups was even and amounted to 97.6, 99.0, and 99.6 kg, respectively. Therefore, post-slaughter weight of hot carcass and dressing percentage were similar.

TABLE 4. Results of carcass evaluation ($\overline{x} \pm SD$).

Specification	Group (n = 8)		
	I Control	II Herbiplant CS 125 ppm	III Herbiplant CS 500 ppm
Pre-slaughter weight (kg)	97.6±5.62	99.0±3.85	99.6±5.66
Post-slaughter weight (kg)	77.1±5.25	79.1±3.09	77.5±5.07
Dressing percentage (%)	79.0±3.00	79.9±3.02	77.9±3.60
Meatiness (EUROP system) (%)	54.69±1.66	54.75±2.02	54.92±1.63
Back fat thickness (mm)	13.12±2.03	13.25±2.19	13.75±1.83
Loineye area (cm^2)	47.25^a±2.91	50.12±3.88	51.25^b±3.84

a,b – $p \leq 0.05$

Meatiness (EUROP system) of fatteners in the all groups was the same (54.69, 54.75, 54.92%). The preparation applied in feed mixtures also did not affect the decrease in back fat thickness. A significant ($p \leq 0.05$) influence of *Herbiplant CS* was observed in the case of loin eye area, but only between control and III group. Another investigation [Korniewicz, 2004] proved that plant extracts applied at a dose of 200 g/t of feed mixture also influenced the increase in loin eye area (from 47.2 to 49.0 cm^2).

Fatty acids profile of back fat

The results of analysis are given in Table 5, while Table 6 presents the following groups of fatty acids: saturated (SFA), monounsaturated (MUFA), polyunsaturated (PUFA), acids of n-3 and n-6 family group, possessing a hypercholesterolemic activity (OFA) as well as those showing hypocholesterolemic (DFA), according to the criteria by Barowicz *et al.* [2000].

Saturated fatty acids (SFA) constituted about 40% of all acids in back fat. Basic palmitic acid (C16:0) reached 25.58% in the control group. The small decrease in its percentage, up to 24.92%, was observed in group III (*Herbiplant CS* – 500 ppm). Another studies [Korniewicz *et al.,* 2006] proved that palmitic acid contribution was only 22%.

Stearic acid (C18:0) constituted from 12.6 to 12.7%, and the remaining saturated acids percentage contribution was about 2%. On the basis of the results obtained it is possible to conclude that the phytopreparation applied did not affect fermentation in a digestive tract, as well as percentage amount of particular saturated fatty acids in fat deposit.

Monounsaturated fatty acids (MUFA) constituted together about 48.5% in fatteners back fat in all groups. Major MUFA in that group was oleic acid (C18:1n9c) that reached 44%. Palmitooleic acid (C16:1n7) content was at a level of 3%. Any participation of erucic acid in fat from pigs of all groups was demonstrated. In back fat collected from experimental fatteners a significant ($p \leq 0.05$) increase was observed in the contents of heptadecenoic acid (C17:1n7) and elaidic acid (C18:1n9t).

The level of polyunsaturated fatty acids (PUFA) was about 11% in fatteners back fat in all nutritional groups. Linoleic acid (C18:2n6c) was the main one in this group, and reached

TABLE 5. The profile of fatty acids in fatteners back fat (%).

Fatty acid Symbol	Group (n = 8)		
	I Control	II Herbiplant CS 125 ppm	III Herbiplant CS 500 ppm
Lauric $C_{12:0}$	0.07	0.07	0.07
Mirystic $C_{14:0}$	1.36	1.24	1.29
Pentadecanoic $C_{15:0}$	0.07	0.05	0.07
Palmitic $C_{16:0}$	25.58	25.89	24.92
Heptadecanoic $C_{17:0}$	0.34	0.40	0.48
Stearic $C_{18:0}$	12.62	12.69	12.70
Arachidic $C_{20:0}$	0.18	0.24	0.18
Heneicosanoic $C_{21:0}$	0.01	0.03	0.05
Tricosanoic $C_{23:0}$	0.16	0.17	0.18
Total SFA	40.39	40.78	39.94
Palmitooleic $C_{16:1n7}$	3.00	2.77	2.94
Heptadecenoic $C_{17:1n7}$	0.35[a]	0.38	0.47[b]
Elaidic $C_{18:1n9t}$	0.17[a]	0.22[b]	0.22[b]
Oleic $C_{18:1n9c}$	44.30	44.00	44.08
Eicosenoic $C_{20:1n9}$	0.97	1.00	0.95
Erucic $C_{22:n9}$	0.00	0.00	0.00
Total MUFA	48.79	48.37	48.66
Linoleic (LA) $C_{18:2n6c}$	9.34	9.42	9.79
γ-linolenic $C_{18:3n6}$	0.00	0.00	0.00
α-linolenic $C_{18:3n3c}$	0.60	0.60	0.64
Eikosadienoic $C_{20:2n6}$	0.59	0.52	0.60
Cis-8.11.14 eicosatrienoic $C_{20:n6}$	0.09	0.09	0.09
Arachidonic $C_{20:4n6}$	0.12	0.13	0.13
Docosapentaenoic (DPA) $C_{22:5n3}$	0.08	0.08	0.10
Docosahexaenoic (DHA) $C_{22:6n3}$	0.00	0.00	0.05
Total PUFA	10.82	10.85	11.40

a,b – $p \leq 0.05$

TABLE 6. The content of fatty acids in fatteners back fat (%).

Fatty acids	Group (n = 8)		
	I Control	II Herbiplant CS 125 ppm	III Herbiplant CS 500 ppm
SFAs	40.39	40.78	39.94
MUFAs	48.79	48.37	48.66
PUFAs	10.82	10.85	11.40
n-3	0.68	0.68	0.79
n-6	10.13	10.16	10.61
n-6/n-3	14.90	14.94	13.43
DFA	72.36	72.17	73.09
OFA	26.94	27.13	26.21
DFA/OFA	2.68	2.66	2.79

SFAs – saturated fatty acids; MUFAs – monounsaturated fatty acids; PUFAs – polyunsaturated fatty acids; DFA – neutral and hypocholesterolemic fatty acids (UFAs + $C_{18:0}$); OFA – hipercholesterolemic fatty acids ($\Sigma C_{14:0} + C_{16:0}$)

9.34% in control group. Its content in experimental groups increased to 9.42% and 9.79%. Those differences, however, were not proved statistically.

In back fat of group III docohexaenoic acid (DHA, C22:6n3) was detected at a level of 0.05%. The presence of that acid was not recorded in fat of control group fatteners. This issue requires further investigations.

Fatty acids of the n-3 family were at a level of 0.7% and those of the n-6 family reached 10%. No statistically significant differences were found between the nutritional groups. The ratio of n-6 to n-3 acids groups in control group amounted to 14.89, and in group III it became slightly lowered to 13.43, which can be considered as a beneficial tendency. Research conducted by Rey *et al*. [2001] proved 20% reduction of the mentioned ratio in the fat of fatteners that were given feed supplemented with 0.5% fish oil.

Any alterations in acid ratio regarding those of hypoholesterolemic (DFA) and hiperholesterolemic activity (OFA) were observed. In all the groups, the ratio was about 2.7. Barteczko *et al.* [2001] also did not record any statistically significant differences in DFA and OFA content in back fat of fatteners that were fed with feed mixtures supplemented with vegetable oils.

The lack of considerable significant differences in acids profile is fully justified, as fatty acids profile of back fat is determined mainly by the kind of fat introduced to feed mixture. According to Usydus [2005], fish oil administration to fatteners in feed mixture influences the increase in PUFAs and n-3 group acids fraction, which is of considerable dietetic value. In turn, Mitchaothai *et al.* [2007] added 5% bovine fat or sunflower oil to *grower* and the *finishe*r type feed mixtures for fatteners. These authors estimated the influence of this fat on the composition of fatty acids of back fat, intermuscular fat and liver. It was shown that addition of sunflower oil caused a decrease in the sum of SFA in back fat from 38.01 to 30.88%, and the sum of MUFA from 44.80 to 38.66%, as well

as enlargement of the sum of PUFA from 14.23 to 29.56%. As a result, the extension of the relations between n-6 to n-3 fatty acids from 9.5 do 25.0 was observed.

Thus, the addition of the phytopreparation did not influence the fatty acids profile of fatteners back fat, however, the beneficial influence of herbs and plant extracts on sensory attributes of meat and fat is not out of the question, which has been shown in some papers [Grela, 2000a; Li *et al*., 2006; Calkins & Hodgen, 2007; Janz *et al*., 2007].

CONCLUSIONS

1. Feed mixtures of *starter*, *grower* and *finisher* type supplemented with plant extracts (*Herbiplant CS*) a a dose of 125 and 500 mg/kg were applied in a three-stage fattening. That resulted in an increase in daily body weight gains of fatteners by 3.8 and 5.0% as compared to the control group (896 g/day).

2. Feed intake per 1 kg of body weight gain within the whole period of fattening amounted to 2.67 kg in control group, and it was lower by 4.9 and 6.4% in the groups supplemented with *Herbiplant CS.*

3. The applied phytopreparation (*Herbiplant CS)* did not influence the carcass features, and the only observed influence involved increased loin eye area.

4. The assessed preparation did not affect significantly saturated (SFA), monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids profile of back fat.

5. *Herbiplant CS* at the dose of 500 mg/kg supplemented to feed mixture influenced more considerably the improvement of performance results in the first stage of pig fattening; whereas further stages of fattening showed similar efficiency of compared preparation doses (125 and 500 mg/kg).

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EFEKTYWNOŚĆ EKSTRAKTÓW ROŚLINNYCH (*HERBIPLANT CS*) W TUCZU ŚWIŃ

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Celem podjętych badań było określenie wpływu mieszaniny ekstraktów roślinnych (*Herbiplant CS*), jako dodatku paszowego, na wskaźniki produkcyjne, wartość rzeźną i jakość słoniny tuczników. Preparat został sporządzony w Ośrodku Badawczo-Rozwojowym LNB Poland Sp. z o.o. w Kiszkowie i standaryzowany na zawartość substancji bioaktywnych. Fitoreparat ten w postaci sypkiego proszku stosowano do mieszanek pełnoporcjowych typu *starter*, *grower* i *finiszer* w ilości 125 i 500 mg/kg (3 grupy tuczników). Zwierzęta utrzymywano indywidualnie i tuczono od 20 do 100 kg masy ciała. Średnie dobowe przyrosty masy ciała tuczników grupy kontrolnej za cały okres tuczu wynosiły 896 g, a w grupach z dodatkiem *Herbiplantu CS* były większe o 3,8 i 5,0%. Średnie dobowe pobranie mieszanek przez tuczniki w kolejnych okresach tuczu i za cały tucz było podobne we wszystkich grupach. Zużycie mieszanki na 1 kg przyrostu masy ciała za cały okres tuczu w grupie kontrolnej wynosiło 2,67 kg, a w grupach z *Herbiplantem CS* było mniejsze o 4,9 i 6,4%. Stosowane w mieszankach dawki tego preparatu nie miały wpływu na umięśnienie tuszy. Obserwowano jedynie zwiększenie „oka" polędwicy. Oceniany preparat roślinny nie miał istotnego wpływu na profil kwasów tłuszczowych. Zawartość kwasów nasyconych (SFA), jednonienasyconych (MUFA) i wielonienasyconych (PUFA) była podobna. Fitopreparat *Herbiplant CS* w dawce 500 mg na 1 kg mieszanek miał większy wpływ na poprawę wskaźników produkcyjnych w pierwszym okresie tuczu świń. W dalszych okresach tuczu efektywność porównywanych dawek *Herbiplantu CS* (125 i 500 mg/kg) była podobna.