STUDIES ON CULTIVATION SUITABILITY AND NUTRITIONAL CHARACTERIZATION OF LUPINE ALKALOID-FREE VARIETIES

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Abstract

This study had as main objective to establish suitability growth and nutritional characterization of varieties of lupine (Lupinus albus) alkaloid-free and anti-nutritive substances, in the northwest of the country, as an alternative to conventional protein from soy products and by-products. There were two varieties of white lupine (LUBLANC and ENERGY) free of alkaloids that have been cultivated over an area of 1.2 ha, using seed imported from company Joordens Zaden BV in the Netherlands. The results obtained in this study demonstrated suitability cultivation and good nutritional characteristics of the two varieties of lupine alkaloids tested free, the spotted variety Energy superiority both in terms of seed production (2905.2 vs. 2696.6 kg DM / kg) and in terms of crude protein content (44.00 vs. 41.19% CP in DM) and fat (10.69 vs. 7.81% in the DM) have determined a high energy value (3326, 9 vs. 2973.8 kcal EMAn / kg DM). Study the climatic conditions of the area northwest of the country, substantiates the need and opportunity lupine grain cultivation and use free of alkaloids as an important alternative source of protein and energy in poultry diets.

Key word: seed lupine, alkaloid-free, nutritional characterization

INTRODUCTION

In the context of animal flours ban on feeding birds and high cost of products and by-products of soybean, lupine beans can be a promising alternative for providing own production of vegetable protein in bird food in our country. Data from the literature mentions that new varieties of lupine seeds made productions of 3000-5000 kg / ha, containing 31-48% protein and 6-10% fat (depending on weather conditions), but all need to improve the biological value of protein in adding synthetic amino acids. Climatic conditions of our country provides the prerequisites for obtaining a proper lupine grain production quantity and quality. Partial substitution of soy bean cakes lupins in poultry diets do not involve any risk on poultry health and production quality obtained as varieties used without alkaloids and anti-nutritive substances, these being proven research results presented in the literature (Dora et al., 2002; Suchy et al., 2006; Strakova et al., 2008; Nalle et al., 2010).

Using lupins in poultry diets provide some independence from costly imports of products and soy products, but also a reduction in the price / kg feed with positive effects on profit. Introducing culture in Romania lupine leads to diversify crop production with positive impact report request: offer

in a market currently dominated by cereals. In addition lupine beans should not be subjected to heat treatment to destroy the anti-nutritive factors (eg tripsininhibitorii if soybeans) sin are not genetically modified, which makes them an important protein source for organic farms (Dora et al., 2002). These vegetable seeds not only offer a valuable source of protein, But Also of energy due to fat contents (Petterson et al., 2000; Hickling 2003).

Most authors have reported that lupine seeds have a high content of PNA (poliglucide neamidonoase), which have a negative influence over digestion and productive performance of monogastric animals. The nutritive value of lupine seed can be successfully grown (primarily for monogastric animals) by removing coatings (Rubio et al 2003; Mieczkowska et al 2005) and by using appropriate enzymes (Steenfeldt et al., 2003). Compared to soy, lupine beans are lower in phytic acid content and saponins, but in lectins and protease inhibitors, which improves protein digestion (Sujak et al., 2006).

The objective of this study is to study the suitability growth and nutritional characterization of varieties of lupine (Lupinus albus) free of alkaloids and anti-nutritive substances, in the northwest of the country, as an alternative to conventional protein from soy products and by-products

MATERIAL AND METHODS

Research has been conducted at the University of Oradea in 2012. There were two varieties of white lupine (LUBLANC and ENERGY) free alkaloids were grown in SC Rosbro Avicom Ltd over an area of 1.2 hectares, equal for each variety. Seed was obtained from company Joordens Zaden BV in the Netherlands. Were used for sowing 120 kg seed / ha, which was previously inoculated with bacteria *Rhizobium Lupin* admosfera to improve nitrogen fixation. Sowing was done in mid-april at a depth of 1-1.5 cm and a spacing of 20 cm (Faluyi et al., 2000). Grain harvesting has been done in the last decade of august. Because cooking is not uniform grain was necessary conditioning and artificial drying grain.

Samples were analysed for dry matter (DM), ash, crude protein (CP), ether extract (EE) and crude fiber (CF) by standard AOAC methods (AOAC 1996). Crude protein was determined such as nitrogen (N × 6.25). The nitrogen content was determined by the Kjeldahl method (KJELTEC AUTO). Fat was determined by extraction with petrol ether using the SOXTEC HT6. Crude fibre were determined using DOSI-FIBER Analyser. The ash content was determined gravimetrically after sample ashing at 550°C under prescribed NABERTERM conditions. The nitrogen-free extractives (NFE) was calculated according as: NFE = dry matter of the sample – (CP + CF + EE + Ash). The lupine seeds were analyzed for total alkaloids content as described by Ruitz (1977).

Metabolisable energy lupine seeds was calculated taking into account the correction related to nitrogen balance (EMAn). For this calculation we used the equation proposed by Sibbald (1980):

EMAn = 3951 + 54,4 MG – 88,7CB – 40,8Ce;

where MG = ether extract; CB = crude fiber and Ce = ash.

RESULTS AND DISCUSSION

Lupine crop of varieties and Energy Lublanc relatively well developed and under circumstances of poor rainfall and excessive heat, which characterized the summer of 2012. Even in these conditions Lublanc variety deboabe achieved a production of 3165 kg / ha with 14.8% moisture, and the variety Energy has achieved a production of 3386 kg / ha with 14.2% moisture. Thus, the average production of dry matter (DM) was 2696.6 kg / ha, respectively Lublanc variety 2905.2 kg / ha for cultivar Energy, and the crude protein (CP) was 1110.7 kg / ha variety Lublanc and 1278.3 kg / ha for variety Energy (fig. 1). The best production results both grain and crude protein was obtained from cultivar Energy, grain yield was higher with 208.6 kg DM / ha (7.7%) and the crude protein with 167.6 kg CP / ha (with 15.08%) versus Lublanc variety.

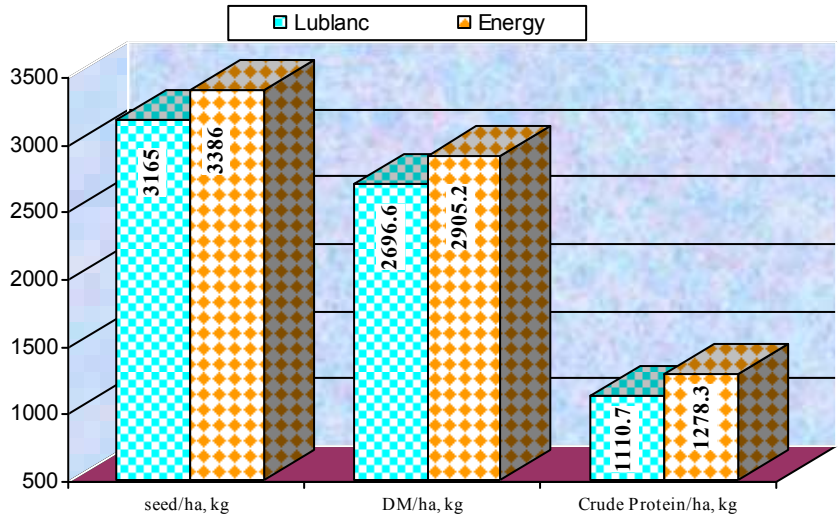

Fig. 1. Lupine seed production and crude protein made by the two varieties tested (kg / ha)

Although weather conditions were not very favorable, white lupine cultivar Energy has made a good grain production, this being at the lower limit quoted in the literature (3000 - 5000 kg / ha seed and approx. 2000 kg protein / ha - Dijkstra et al., 2003; Pisarikova et al., 2009). We believe that

cultivation suitability check two white lupine varieties in the northwest of Romania, during a single crop year is not enough to draw a conclusion and a recommendation that farmers in this area. However, good production made in poor weather conditions allow us to recommend the variety Energy as a kind of perspective, imposing further comparative testing with other varieties of high productivity and free of alkaloids.

Chemical composition and energy value of whole seeds were determined and were reported in dry matter (DM) and to air-dry basis. The data presented in Tables 1 and 2 show that the two varieties of white lupine well behaved under specific climatic zone northwest of the country, producing seeds with high protein and fat, thus constituting an important source energo -protein for poultry feeding.

Table 1

Nutrient content and energy value of lupine seed - % of air-dry basis

Chemicals	Variety	Media	Max.	Min.	d
DM (dry matter)	Lublanc	90,69	92,29	88,98	0,40
	Energy	91,09	93,22	89,49	
Water	Lublanc	9,31	11,02	7,71	0,40
	Energy	8,91	10,51	6,78	
Crude protein	Lublanc	37,36	40,52	32,33	2,72
	Energy	40,08	41,86	37,52	
Crude fat	Lublanc	7,08	8,06	6,18	2,66
	Energy	9,74	12,37	8,58	
Crude fiber	Lublanc	16,68	18,70	14,76	2,01
	Energy	14,67	16,28	12,81	
SEN (nitrogen-free extractives)	Lublanc	25,68	31,23	22,93	2,98
	Energy	22,70	24,71	20,03	
Ash	Lublanc	3,91	4,71	3,24	0,26
	Energy	3,65	4,61	3,28	
EMAn (kcal/kg)*	Lublanc	2697,0	2921,6	2484,7	333,5
	Energy	3030,5	3246,2	2826,6	
Alkaloids (mg/kg)	Lublanc	128,2	194,2	95,3	27,5
	Energy	100,7	158,7	88,1	

*calculated in accordance with Sibbald, 1980.

Energy lupine beans in variety compared to those of the genus Lublanc had a higher crude protein content (44.00 vs. 41.19% CP in DM) and crude fat (10.69 vs. 7.81% fat gross in DM) and lower in crude fiber (16.10 vs. 18.39% crude fiber in DM) and SEN (nitrogen-free extractives) (24.92 vs. 28.31% in DM). Due to higher fat content and lower in crude fiber, seeds of the variety Energy have higher energy value than the 11.87% recorded in variety Lublanc (3326.9 vs. 2973.8 kcal EMAn / kg DM). Brenes et al. (1993a) reported that the high proportion of seed coating (approx. 16% of seed weight) is the leading cause crude fiber content. Thus,

coating removal would significantly reduce crude fiber content, making it comparable nutrient content of lupine seeds to that of soybean (Vecerek et al., 2008; Nalle, 2009).

Table 2

Nutrient content and energy value of lupine seed - % of DM (dry matter)

Chemicals	Variety	Media	Max.	Min.	d
Crude protein	Lublanc	41,19	43,9	36,33	2,81
	Energy	44,00	44,90	41,93	
Crude fat	Lublanc	7,81	8,73	6,94	2,88
	Energy	10,69	13,27	9,59	
Crude fiber	Lublanc	18,39	20,26	16,59	2,29
	Energy	16,10	17,46	14,31	
SEN (nitrogen-free extractives)	Lublanc	28,31	33,84	25,77	3,39
	Energy	24,92	26,51	22,38	
Ash	Lublanc	4,31	5,10	3,64	0,31
	Energy	4,00	4,94	3,66	
EMAn (kcal/kg)*	Lublanc	2973,8	3165,7	2792,4	353,1
	Energy	3326,9	3482,3	3158,6	
Alkaloids (mg/kg)	Lublanc	141,3	214,2	105,1	30,7
	Energy	110,6	174,4	96,7	

*calculated in accordance with Sibbald, 1980.

The results obtained in these studies are in agreement with those obtained in other studies (Rubio et al., 2003; Erbas et al., 2005, Diaz et al., 2006; Sujak et al., 2006; Uzun et al., 2007; Vecerek et al., 2008) and confirms that lupine seeds are an important source of animal protein, but due to high variability between species, it is necessary to determine nutrient content. Crude protein content in soybeans varies between 28 and 48% (% of DM), depending on variety and climatic conditions. Even the same kind of lupine (Juno) protein content varied between 39.8 and 48.2%, depending on the year of harvest (Strakova et al., 2006). Energy value of lupine grain varies between 1920 and 3570 kcal EMAn / kg DM, depending on the variety, climatic conditions and content of alkaloids (Brenes et al., 1993, Hughes et al., 1998, Kocher et al., 2000). The positive effects of using enzymes in lupine-based diets have been demonstrated by several authors (Kocher et al., 2000, Hughes et al., 2000, Brenes et al., 2003; Mieczkowska et al., 2004).

CONCLUSION

The results obtained in this study demonstrated suitability cultivation and good nutritional characteristics of the two varieties of lupine alkaloid-free tested, the spotted variety Energy superiority both in terms of seed production as well as what the content of crude protein and fat which led

high energy value. Study the climatic conditions of the area northwest of the country, substantiates the need and opportunity lupine grain cultivation and use free of alkaloids as an important alternative source of protein and energy in poultry diets.

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