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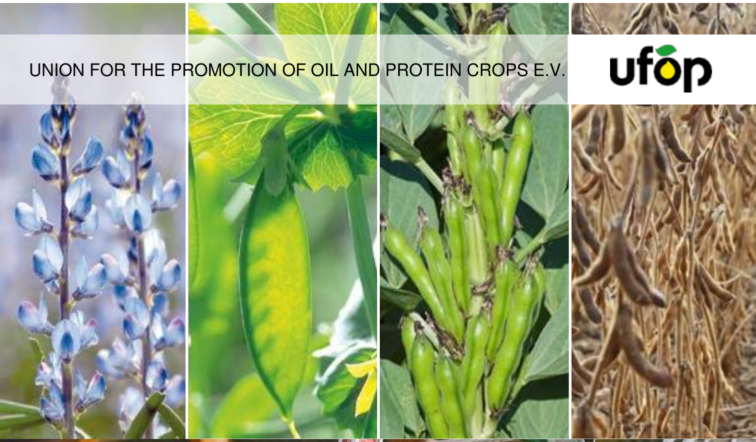

UFOP PRACTICE INFORMATION

Faba bean, grain pea, sweet lupin and soybean for feeding cattle

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Content

Introduction

Grain legumes have long been considered valuable crops in agriculture. In addition to providing a break in cereal-based crop rotations, they make an important contribution to the regenerative nitrogen supply in arable farming through their ability to fix nitrogen with the help of root nodule bacteria. Pea, faba bean, sweet lupin and European-grown soybean have recently attracted increasing interest. The potential of domestic grain legume production to contribute to the sustainable development of our farming systems is receiving increasing attention. They broaden the feed resource base. This and measures in the Common Agricultural Policy are reflected both in the expansion of cultivated areas and in the breeding of new varieties.

Domestic grain legumes have almost disappeared from our livestock diets in recent years. Practical experience in handling them and knowledge of their feeding effects is also lost. In addition, the feeding practices and general livestock management conditions and resulting animal performance have changed. Farmers involved in livestock production have also changed. It is time for a fresh look at the utility of European-grown grain legumes in ruminant feeding by combining new knowledge with the tried and tested insights and established practices.

This UFOP publication provides an overview of the composition, feeding value, and possible uses of grain legumes in ruminant feeding. In particular, the results of feeding trials over the last ten years are considered. For faba bean, both white-flowered and coloured-flowering varieties are considered. For pea, the focus is on white-flowered varieties. These dominate the market but coloured-flowered varieties are suitable for feeding ruminants. Sweet blue lupin and white lupin are also considered. Full-fat soybean is the most important feedstuff from domestic (European) soybean cultivation.

Constituent and feed value of grain legumes

The value-determining constituents of the "classic" domestic grain legumes (faba bean, white-flowered pea and sweet lupin, and soybean as a "new" European-grown grain legume) are shown in Tables 1a and 1b. Grain legumes are used in livestock feed primarily for their high protein content. The crude protein contents for the grain legumes, shown in Tables 1a and 1b, differ considerably. The protein content of pea is about 20%. Faba bean has a higher protein concentration. Soybean and sweet white lupin (Table 1b) have the highest crude protein concentrations with more than 30%.

The ruminal crude protein degradation of pea and lupin was comprehensively investigated in a recent study using an in-situ method in which the feeds are incubated in permeable polyester bags in the rumen (Seifried et al. 2016). An average of 13 and 12 varietally pure samples showed an effective crude protein (UDP) stability of 17 and 23 % for pea and lupin for an assumed passage rate of 5 and 8 % per hour respectively. While the variation between samples was very small for pea (15 to 19% and 20 to 26% for UDP5 and UDP8, respectively), a larger variation was found in lupin (12 to 24% and 17 to 33% for UDP5 and UDP8, respectively). An explanation for this variation has not yet been found. However, it offers opportunities for plant breeding in the development of new varieties. Unfortunately, no comparable up-to-date data material is available for the protein value of European-grown faba bean.

Table 1a: Value-determining constituents (typical mean content values and ranges), energy and protein values of grain feed pea and faba bean for cattle feeding (data at 88 % dry matter (DM))

Item		Pea (white flowering)		Faba bean (coloured/white flowering)	
Crude ash	g/kg	33	*25 – 50*	35	*28 – 42*
Crude protein	g/kg	200	*150 – 260*	260	*230 – 290*
UDP5[1]	% XP	17		15	
UDP8[2]	% XP	23		20	
nXP5[3]	g/kg	163		171	
nXP8[4]	% XP	170		181	
RNB5[5]	g/kg	6		14	
RNB8[6]	g/kg	5		13	
Ether extract	g/kg	13	*10 – 20*	14	*10 – 20*
Crude fibre	g/kg	57	*50 – 70*	86	*50 – 100*
aNDFom[7]	g/kg	100	*80 – 120*	135	*100 – 200*
ADFom[8]	g/kg	70	*60 – 80*	106	*75 – 130*
Starch	g/kg	430	*350 – 500*	390	*330 – 430*
Resistant starch	% XS	21		20	
Sugar	g/kg	40	*20 – 60*	28	*10 – 40*
Digestibility OM[9]	%	91		91	
Digestible Ether extract	%	72		80	
Digestible crude fibre	%	81		87	
Metabolisable energy (ME)	MJ/kg	11.9		12.0	
Net energy lactation (NEL)	MJ/kg	7.5		7.6	
Calcium	g/kg	1.0	*0.6 – 2.0*	1.2	*0.8 – 1.6*
Phosphorus	g/kg	4.1	*3.5 – 5.0*	5.5	*4.0 – 7.0*
Magnesium	g/kg	1.3	*1.2 – 1.5*	1.4	*1.1 – 1.8*
Sodium	g/kg	0.2	*0.1 – 0.3*	0.2	*0.1 – 0.4*
Potassium	g/kg	11.7	*11.1 – 12.0*	13.9	*11.7 – 14.7*

1, 2 Undegraded crude protein, passage rate 5 or 8 %/h;
3, 4 Usable crude protein at the duodenum, passage rate 5 or 8 %/h;
5, 6 Ruminal nitrogen balance; passage rate 5 or 8 %/h;
7 Neutral detergent fibre; ash-free, after amylase treatment;
8 Acid detergent fibre, ash-free;
9 Organic matter.

Sources: UFOP 2015; Mitteilungen Bayerische Landesanstalt für Landwirtschaft 2013-2015; Jeroch et al. 2016; DLG 1997; Seifried et al. 2016; CVB 2011.

Table 1b: Value-determining constituents (typical mean content values and ranges). energy and protein values of sweet lupin and soybean for cattle feed (data at 88 % DM)

Item		Blue sweet lupin		White sweet lupin		Soybean (European)	
Crude ash	g/kg	35	30 – 50	35	30 – 50	47	45– 53
Crude protein	g/kg	289	*180 – 330*	339	*200–350*	340	*250–450*
UDP5[1]	% XP	17		17		20	
UDP8[2]	% XP	23		23		25	
nXP5[3]	g/kg	189		200		168	
nXP8[4]	% XP	202		207		182	
RNB5[5]	g/kg	16		22		27	
RNB8[6]	g/kg	14		21		25	
Ether extract	g/kg	56	*42 – 65*	83		200	*140–240*
Crude fibre	g/kg	140	*110 – 170*	113		55	*30– 80*
aNDFom[7]	g/kg	220	*150 – 240*	167		130	*100–150*
ADFom[8]	g/kg	180	*140 – 240*	128		90	*70– 100*
Starch	g/kg	(70)[9]	*10 – 150*	(77)[9]		(52)[9]	*20– 70*
Sugar	g/kg	50	*20 – 70*	64		71	*60– 90*
Digestibility OM[10]	%	93		90		87	
Digestible ether extract	%	86		91		94	
Digestible crude fibre	%	92		94		76	
Metabolisable energy	MJ/kg	12.9		13.1		14.5	
Net energy lactation	MJ/kg	8.1		8.3		9.1	
Calcium	g/kg	2.5	*2.0– 2.9*	1.9		2.5	*1.7– 3.3*
Phosphorus	g/kg	4.1	*3.4– 4.9*	4.8		5.8	*5.0– 7.0*
Magnesium	g/kg	1.7	*1.5– 1.8*	1.3		2.5	*2.1– 3.2*
Sodium	g/kg	0.1		0.4		0.2	*0.1– 0.4*
Potassium	g/kg	13.4		10.6		19.9	*15.7–23.9*

1, 2 Undegraded crude protein, passage rate 5 or 8 %/h;
3, 4 Usable crude protein at the duodenum, passage rate 5 or 8 %/h;
5, 6 Ruminal nitrogen balance; passage rate 5 or 8 %/h;
7 Neutral detergent fibre, ash-free. after amylase treatment;
8 Acid Detergent fibre, ash-free;
9 Starch. measured with the polarimetric method, where non-starch components are also recorded;
10 Organic matter.

Sources: UFOP 2015. Mitteilungen Bayerische Landesanstalt für Landwirtschaft 2013-2015; Jeroch et al. 2016; DLG 1997; Seifried et al. 2016; CVB 2011; Zuber et al. 2019.

The UDP are around 20% (DLG. 2001; CVB 2011). The UDP content of untreated full-fat soybean is likely to similar. Our own in-situ investigation confirms this assumption (Steingaß et al. 2015). Corresponding to the relatively low UDP content combined with the high contents of metabolizable energy (ME) described below, average contents of usable crude protein between 150 and 190 g and 165 and 200 g result for passage rates of 5 and 8 % per hour (nXP5 and nXP8. respectively). Lupin is highest due to the higher crude protein content rather than the higher crude protein stability, followed by faba bean and pea.

Since a considerable proportion of the convertible energy in soybean is supplied by fat, the nXP content here is lower than in soybean due to a proportion of microbial protein at the level as low as that of faba bean despite the high crude protein content. For all grain legumes, especially for the species rich in crude protein, a considerably positive ruminal nitrogen balance (RNB) is calculated which must be taken into account in ration planning. For ration planning, it is recommended to use the values for UDP, nXP and RNB at a passage rate of 5% per hour for a medium feeding level for cows and (fattening) cattle. For high-yielding cows with a dry matter intake above 20 kg/day, it is recommended to use a passage rate of 8% per hour.

Soybean and lupin are often subjected to (hydro)thermal treatment (toasting). Faba bean and occasionally pea are also heat-treated. Our own in-situ investigations of lupin showed an increase in the UDP content by approximately 10%, which increases the nXP content by approximately 15 g/kg. Effects of a comparable magnitude are also expected in faba bean whereas there are indications that these effects are smaller in pea. Since the effects of a treatment on the UDP and nXP contents can vary greatly depending on the process, it is recommended to have such products tested in individual cases using suitable methods (e.g., chemical crude protein fractionation, extended Hohenheim feed value test). In the case of pea and faba bean, thermal treatment must be considered carefully, as starch digestion can occur resulting in faster and more extensive degradation in the rumen, which is not desirable in cattle feed.

Comparable to cereals, the content of neutral detergent fibre (aNDFom) in pea is about 10%. Significantly higher contents can be found in faba bean and especially in lupin. It should be emphasised that this nutrient fraction has a digestibility of more than 80% in ruminants and is predominantly fermented to acetic acid in the rumen. This can contribute to a stabilisation of the milk fat content especially if, as in the case of lupin, no starch is introduced into the ration at the same time. Starch, on the other hand, is found in high concentrations in pea (43%) and faba bean (39%). New studies (Seifried et al. 2016) have shown that the ruminal degradation of pea starch is relatively delayed so that a stability of about 20 to 30% can be expected. For faba bean, the CVB (2011) indicates a stability of 20%. If the starch content of lupin and soybean is analysed using the polarimetric method, contents of about 5 to 10% are found. It can be assumed that these values are excessive and result from the presence of polarising non-starch substances. For this reason, the starch contents for lupin and soybean are given in brackets in Table 1b.

The fat content of pea and faba bean are insignificant at less than 2%. Much higher fat contents are found in lupin, between 4 and 9%, depending on origin. Soybean contains about 20% fat with considerable variation between 14 to 24%. While the fat content of lupin does not limit its use in rations for ruminants, the fat content limits the use full-fat soybean. This is explained in more detail in the ration examples. The fat of both soybean and lupin is characterised by a high proportion of polyunsaturated fatty acids, dominated by linoleic acid. An impact on the fatty acid composition of the milk fat is therefore to be expected when full-fat soybean or lupin are used for feeding dairy cattle. It is to be expected that the proportion of long-chain and unsaturated fatty acids, including trans- and conjugated fatty acids, will increase in milk at the expense of short- and medium-chain saturated fatty acids. This is quite beneficial for human nutrition.

New results of digestion tests on sheep with pea, faba bean and lupin have become available in recent years. A very uniform picture emerges. The digestibility of the organic matter is over 90% in each case. The digestibility of the individual raw nutrients, including the fibre fractions, is consistently very high. This results in contents of metabolizable energy (ME) and net energy lactation (NEL) at about 12 MJ and 7.5 MJ/kg for pea and faba bean respectively, and 13 MJ and about 8 MJ/kg for lupin. Unfortunately there are no correspondingly extensive data for soybean. However the available results show a high digestibility of the organic matter (OM) of about 87%. Combined with the high fat content, this results in ME and NEL contents of 14.5 MJ and 9.1 MJ/kg respectively. To calculate the ME and NEL contents more accurately in individual cases with differing ingredients. The digestibility of OM, fat, and fibre necessary for calculating the ME are given in Table 1b. For all crop types, neither thermal treatment nor the origin from organic or conventional cultivation has an influence on the energy values. Grain legumes are thus among the most energy-rich feedstuffs, comparable to de-husked cereals. Compared to cereals, they also contain at least twice as much crude protein, which further enhances their feed value.

Faba bean and pea have very low calcium contents, comparable to cereals. Lupin and soybean have higher levels. Faba bean and soybean are high in phosphorus, while pea and sweet lupin have medium phosphorus contents. Phosphorus is predominantly bound to phytin. However, it can be assumed that the phytates are largely hydrolysed in the rumen by microbial phytases and the phosphorus is available to the ruminant. However, there is evidence that thermal treatment can reduce microbial phytate degradation along with the desired reduction in protein degradation. Like most arable crops, grain legumes also have very low sodium contents, at least on sites far from the coast.

One characteristic of the legume family is the presence of various secondary compounds. The seeds of our native grain legumes are also characterised by this. Tannins are found in faba bean and pea. Tannin levels are influenced by genetics and so varietal choice is the key factor. Coloured-flowering pea and faba bean have higher tannin contents than white-flowered varieties, which often have no tannins at all. In contrast to pigs and poultry, where higher tannin contents can reduce feed intake and performance, tannin levels are of no negative consequence in ruminant feeding. Tannin contents of up to 1%, as found in coloured-flowering varieties, are even an advantage as it reduces the degradation of starch and especially the crude protein in the rumen somewhat and can thus contribute to a higher content of UDP and nXP as well as to a more stable rumen fermentation. Lupin contains alkaloids. Through breeding measures ("sweet lupin"), the alkaloid content has been significantly reduced. The current varieties have a total alkaloid content of less than 0.5 g/kg (<0.05% in the grain) and can therefore be used in feeding without hesitation. Protease inhibitors and lectins are found in high concentrations in untreated soybean. They are found also in pea and faba bean. However, it can be assumed that these substances - they are protein bodies - are degraded in the rumen and thus inactivated, so that in this respect thermal treatment for inactivation is not necessary. The fact that grain legumes can be used in ruminant feed in an untreated state brings considerable advantages in terms of costs and logistics and significantly facilitates on-farm use.

Examples of formulations and recommendations for use

Several feeding trials with dairy cows are described in the literature in which grain legumes were used as the sole source of protein or, more often, in combination with other protein carriers. The amount of grain legumes used varied between 2 and up to 5 kg per cow

Table 2: Concentrate feed with grain legumes for a daily yield of 25 kg ECM[1] according to NEL and nXP (data in kg fresh matter)

Item	Rations with			
	Pea	Faba bean	Sweet lupin	Soybean
Grass silage (35% DM 6.4 MJ NEL/kg DM)	19.0	19.0	19.0	19.0
Maize silage (35% DM 6.6 MJ NEL/kg DM)	19.0	19.0	19.0	19.0
Straw	0.5	0.5	0.5	0.5
Pea	2.8			
Faba bean		4.2		
Sweet lupin			3.9	
Soybean				2.0
Rapeseed meal	2.8			1.0
Wheat				1.0
Mineral feed (25 % Ca/0 % P/10 % Na)	0.15	0.18	0.15	0.15
Characteristic values:				
DM intake kg/animal and day	17.8	17.6	17.3	17.4
Energy concentration MJ NEL/kg DM	6.7	6.8	6.9	6.9
Usable crude protein g/kg DM	149	149	154	154

[1] ECM: Energy corrected milk

and day compared to rations with soybean or rapeseed meal or mixtures of both components. There were no negative effects on feed intake, milk yield and milk content in the feed groups supplied with grain legumes. The authors therefore conclude that grain legumes can make a valuable contribution to meeting the nutrient requirements of high-yielding dairy cows.

Feed formulations with grain legumes are presented here whereby alternative grain legumes make up a higher proportion of the diet and thus contribute significantly to covering nutrient requirements. The calculations are based on the nutrient contents shown in Table 1a and Table 1b. Good quality grass and maize silage were used as roughage component in a ratio of 1:1 based on dry matter intake. To supplement the structure, 500 g of straw per animal and day were used in all rations.

Table 2 shows concentrate feed formulations for a performance of 25 kg ECM per animal and day. These rations are balanced in terms of NEL and usable crude protein for the stated performance. The dry matter intake is between 17.3 and 17.8 kg per animal and day. With faba bean and lupin, the necessary protein balance can be achieved without further protein carriers where around 4 kg is used. Pea has significantly less crude protein so that additional rapeseed meal must be used. This is also necessary for full-fat soybean as its intake quantity should be limited to 2 kg per cow and day due to the high fat content. For soybean, the use of soybean press cake instead of soybean would be more advantageous as the reduced fat content at about 10% provides greater flexibility. A phosphorus-free mineral feed is used in quantities of 150 g to 180 g per animal and day to prevent mineral deficiencies. The feeds then have an energy concentration of 6.7 MJ to 6.9 MJ NEL/kg DM with a crude protein content of about 150 g/kg DM.

Feed is formulated according to Table 3 for daily milk yields above 25 kg ECM. Feed intake and concentrate feed provision are calculated according to the specifications of Gruber et al. (2004). The lactation curve of cows with an annual yield of 9,000 kg milk provides the basis for calculations. A concentrate feed with 7.0 MJ NEL and 175 g nXP/kg is used with quantities between 1.4 and 9.5 kg being fed depending on performance. The values shown in the table apply to the rations using faba bean. Comparable feed values are obtained for rations using pea, lupin or soybean. Both the nXP and the supply of easily fermentable carbohydrates and structural carbohydrates correspond to the supply recommendations of the DLG for high-yielding dairy cows.

Diet formulations for total mixed rations for a 37 kg ECM per animal and day are provided in Table 4. This is a good way to feed cows in the first half of lactation. In addition to the roughage already described above, 4 kg of pea are used in the first example. To cover the nXP requirement, an additional 2.8 kg of rapeseed meal must be added.

The ration is further supplemented with molasses beet pulp pellets, wheat and maize, of which about 1 kg each is used. The DM intake is 22.8 kg and the energy concentration is 7 MJ NEL/kg DM. The content of crude protein and nXP is just under 160 g/kg DM from which a balanced ruminal nitrogen balance is derived. The content of easily fermentable carbohydrates and structural carbohydrates again corresponds to the specifications of the DLG for the supply of high-yielding dairy cows. With a structural value of 1.4 the acidosis risk of the ration should be low. In all ration examples (Table 4) a phosphorus-free mineral feed is used.

Table 3: Formulation of concentrate feed for high performance milk production (7.0 MJ NEL/kg; 175 g nXP/kg) using legumes

	Milk yield				
	28	32	36	39	40
Lactation day	200	150	100	60	40
Milk yield feed kg/animal and day	1.4	3.5	6.2	8.6	9.5
Characteristic values*					
DM intake kg/animal and day	18.8	20.4	22.0	23.1	23.5
Energy concentration MJ NEL/kg DM	6.9	7.0	7.1	7.2	7.2
Useable crude protein g/kg DM	153	159	166	171	173
Degradable starch + Sugar. g/kg DM	233	245	251	255	258
aNDFom g/kg DM	321	298	287	281	275
Structural value	1.6	1.5	1.4	1.2	1.2

Example for the ration with faba bean; characteristic values of the other ration are in a comparable order of magnitude.

In the rations with faba bean, sweet lupin and soybean, protected rapeseed meal should be used because otherwise the rumen nitrogen balance values are strongly positive which would result in unnecessary nitrogen losses. The use of lupin results in the highest energy content of 7.2 MJ NEL/kg DM which reflects the advantages of this legume.

Due to the higher fat content of soybean, its inclusion is limited to about 2 kg. At 46 g/kg DM, this ration has the highest fat content. The fat intake is still within the physiological guidelines. There is no reason to fear that the fermentation processes in the rumen will be impaired. The examples have shown that 4 to 5 kg per cow and day of pea, faba bean and sweet lupin can be used. In the case of the lower-protein pea, rapeseed meal at just under 3 kg is required to cover the protein requirement. Rations with faba bean and lupin require the use of protected rapeseed meal at about 1.5 kg to prevent excessive nitrogen supply.

Table 4: Total mixed rations with grain legumes for a daily yield of 37 kg ECM[1] according to NEL and nXP (data in kg fresh matter)

Item	Rations with			
	Pea	Faba bean	Sweet lupin	Soybean
Grass silage (35 % DM 6.4 MJ NEL/kg DM)	19.0	19.0	19.0	19.0
Maize silage (35% dry matter. 6.6 MJ NEL/kg DM)	19.0	19.0	19.0	19.0
Straw	0.5	0.5	0.5	0.5
Pea	4.0	.	.	.
Faba bean	.	4.7	.	.
Sweet lupin	.	.	4.2	.
Soybean	.	.	.	2.0
Rapeseed meal	2.8	1.5*	1.3*	2.8*
Molassed sugar beets pulp	1.0	1.0	1.5	2.2
Wheat	1.0	1.0	1.0	1.0
Maize	1.2	2.5	1.4	1.5
Mineral feed (25% Ca/0% P/10% Na)	0.2	0.25	0.2	0.18
Characteristic values:				
DM intake kg/animal and day	22.8	22.5	22.3	22.4
Energy concentration MJ NEL/kg DM	7.0	7.1	7.2	7.1
Usable crude protein g/kg DM	158	160	161	163
RNB g/kg	4	3	-- 4	-- 1
Ether extract g/kg DM	30	29	37	46
unstable Starch + Sugar g/kg DM	241	245	188	196
aNDFom g/kg DM	315	297	321	299

[1] ECM: Energy corrected milk
*protected

Because of the high fat content, the use of soybean should be limited to about 2 kg. This results also in a higher use of protected rapeseed meal compared to the rations with faba bean and lupin.

The on-farm economic effect of using grain legumes must be examined on a case-by-case basis. This requires information on the costs of the alternative feedstuffs as well as their nutrient content. The determination of the substitution equivalents is the foundation of calculations. This quantifies the amount of the standard feed ingredient that is needed to achieve the same nutrient supply as from 100 kg of the respective grain legume. In dairy cow feeding, the exchange ratios shown in Table 5 apply on the basis of the NEL and the usable crude protein for wheat and rapeseed meal. Table 6 set out the substitution equivalents calculated for cattle fattening on the basis of the ME and the crude protein. The calculations are made according to mathematical equations that also allow negative numbers as solutions, as in the case of soybean. Multiplying the substitution equivalents by the respective prices results in the comparative price for the respective grain legume.

Table 5: Substitution equivalents for nutritional parity when replacing wheat and rapeseed meal with grain legumes in dairy cow feeding

100 kg ...	can substitute for wheat (kg)	and by rapeseed meal (kg)
Pea	85.4	17.5
Faba bean	79.7	25.0
Sweet lupin	66.4	48.9
Soybean	142.6	- 24.4

Table 6: Substitution equivalents for nutritional parity when replacing wheat and rapeseed meal with grain legumes in cattle fattening

100 kg ...	can substitute for wheat (kg)	and ... kg rapeseed meal
Pea	64.2	41.7
Faba bean	50.2	57.7
Sweet lupin	50.4	65.3
Soybean	52.4	79.3

Conclusion

Grain legumes, which include domestically grown soybean, are among the most energy-rich feedstuffs, comparable to de-husked cereals. Neither thermal treatment nor origin from organic or conventional cultivation has any influence on their energy values. They contain medium to high levels of crude protein which further enhances their feed value. However, there is considerable variation between batches of the same species due to varietal, soil, and weather effects. It is therefore always advisable to arrange for appropriate analyses to enable correct and appropriate use in feeding. The crude protein content of grain legumes differs considerably between batches. There are also very clear differences in the starch and crude fat content which determines the overall usability in ruminant feeding because of the necessary balance of the value-determining constituents in a ration. The very high energy content is due to the high starch or fat content and the high digestibility of the fibre. Recent results from digestibility tests on materials used in practice indicate a higher digestibility of the organic matter and thus better energy values than previously assumed. Untreated grain legumes have relatively low UDP contents in the crude protein and therefore a strongly positive RNB which has to be taken into account when designing the ration. With regard to use in conventional or organic ruminant husbandry, there are no differences in feed value.

The anti-nutritional substances in grain legumes do not constrain use in ruminant feeding. Tannin, especially in the coloured flowered bean and pea varieties, has a positive effect on the rumen stability of the protein. Sweet lupin can be used without hesitation in feeding. An increase in the UDP content can be expected through (hydro)thermal treatment (toasting).

However the effects of thermal treatment must be weighed up especially in the case of starch-rich pea and faba bean. Toasting can lead to a breakdown of the starch and thus to its increased degradability.

The usability of grain legumes in ruminant rations is primarily determined by the requirements of ration optimisation. For example in the case of pea and faba bean, the relatively high starch input must be taken into account. In the case of intact soybean (full-fat soybean), and to a lesser extent lupin, the fat content of the total ration must be kept in mind. The anti-nutritional ingredients do not lead to a restriction of use in the ruminant ration. The fact that no heat treatment is required brings cost advantages and significantly facilitates on-farm use.

Feeding trials with dairy cows described in the literature, including studies of high-performance cows, of grain legumes as the sole source of protein or in combination with other protein carriers show an equal performance capability compared to the use of soybean meal and rapeseed meal. The use of indigenous grain legumes in ruminant feeding can therefore be recommended without restriction in the case of balanced feeding in accordance with the ration specifications. Attention should be paid to proper harvesting, preservation and storage if necessary. In case of acceptance problems, the hygienic quality of the legumes should be checked first. as mould contamination cannot be ruled out in the case of grain moisture above 12% during storage.

Notes

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