TEXTE 19/00

Haltbarkeit von pflanzlichen Verbreitungseinheiten nach Magen-Darm-Passage

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11. Zusammenfassung

Ziel der vorliegenden gutachterlichen Stellungnahme war, die Tierarten aufzuführen, die als mögliche Verbreitungsquelle von Verbreitungseinheiten nach der Magen-Darm-Passage anzusehen sind und die Ausscheiduung intakter Verbreitungseinheiten abzuschätzen. Unter Einbeziehung der Anbauflächen, der quantitativen Erntemengen, der ernährungsphysiologischen Grundlagen der relevanten Tierarten, der Futteraufnahmekapazität sowie des Bedarfes erfolgte die Schätzung der Ausscheidung intakter Verbreitungseinheiten. Die Literaturrecherche ergab, dass hierüber definitiv keine systematisch angelegten Untersuchungen vorliegen. Insbesondere fehlen Untersuchungen über das Auflaufen von ausgeschiedenen Verbreitungseinheiten unter den natürlichen Bedingungen. Keimfähigkeitsuntersuchungen unter standardisierten Bedingungen können hierfür nicht herangezogen werden. Die Aufnahme von Verbreitungseinheiten erfolgt sowohl durch Wildgeflügel sowie Sing- und Zugvögel, als auch durch die üblicherweise im Wald lebenden Tierarten. Besonders hervorzuheben sind Tierarten, die Wintervorräte anlegen. Maßnahmen die auf die mögliche Minderung des Verbreitungsrisikos ausgerichtet sind, wirken dem Naturschutz entgegen. Entsprechend kann das Verbreitungsrisiko, z.B. von gentechnisch veränderten Kulturpflanzen, nur durch die Erhöhung der Verdaulichkeit und damit durch Reduktion des Ligningehaltes in der Samenschale begegnet werden. Regionalspezifische Ausrichtungen auf die Anpflanzung bieten keine wesentlichen Vorteile, da die für die Verbreitung relevanten Kleinnager mit einer Populationsgröße zwischen 30 und 60 Tieren je ha in allen Regionen vorkommen. Mindestabstände von Wäldern und Hecken von 200 m bieten nur eine begrenzte Reduktion des Aufnahmerisikos durch die in diesen Lebensräumen befindlichen Tierarten. Erschwerend kommt hinzu, dass die Verbreitungseinheiten in der Regel in den jahreszeitlichen Perioden mit geringem natürlichem Futterangebot als wesentliche Nahrungsquelle vorliegen. Künftige Untersuchungen sollten systematisch die Keimfähigkeit der ausgeschiedenen Verbreitungseinheiten unter natürlichen Bedingungen prüfen. Aufgrund der weitestgehenden Vergleichbarkeit der Bedingungen im Verdauungstrakt von freilebenden Tierarten und den Nutztieren können diese Untersuchungen an Wiederkäuern, Hühnervögel und Monogastriden mit und ohne funktionellem Blinddarm vorgenommen werden. Als vorgeschaltetes Screeningverfahren können hierfür auch *in-vitro*-Systeme Verwendung finden.

12. Summary

Goal of this advice was to show the amount of the germination in seeds from cultural plants (potato, tomato, wheat, barley, oat, maize, rape, rapge, cabbage, mustard, radish, linseed, lucerne, chicory, sugar beet, fodder beet, grape, bean, pea, trees) after passing the gastro-intestinal-tract in wildlife animals.

After a brief information about the botanical background and the main nutrients in the cultural plants and the digestibility, the different anatomical and physiological conditions of the relevant species were described. It was shown that the conditions between wildlife and domesticated animals were nearley identical. However take in mind that parasites and other diseases can reduce the digestibility much more than in domestic animals.

In order to estimate the risk of germination in seeds after passing the gastro-intestinal-tract knowledge of the feed intake on a dry matter base is an essential parameter. The feed intake depends mainly on the energetic requirements. However in this field are only few literature data available. Therefore the data for domestic animals were used for calculations of the maintenance requirement. The dry matter intake was calculated by 5% of the body weight. For animals with body weights > 10 kg, 3% of the body weight was used for the dry matter intake.

The feed intake is mainly depending on the energy requirements. Values for these data however are limited. An estimation of the requirements is given in the following table.

Energy requirements for wildlife animals

	Maintenance (kJME/kg^{0,75})	**Growth**	**Pregnancy x of maintenance**	**Lactation**	**Fly x**
Mammal	370 - 550	1,4	1,2 - 2,4	2,5 - 3,5	
rat	460	1,4	1,2 - 2,4		
mouse	735	1,5	1,2 - 2,4		
poultry	480	1,5			2,0
birds					1,2 - 1,8
- passerines	750 - 850	1,2			1,2 - 1,8
- non passerines	500 - 550	1,2			

The amount for excreting intact seeds can be calcultated by the feed intake and the digestibility of the different seeds of the cultivated plants. In the following the estimated values are given for each type of gastro-intestinal-tract.

Potato

Estimation for the excreting rates of potato berries

Values in g per bodyweight

		Digestibility (%)	Potato berry		
Part of intake	**%**		20	50	100
Typ of digestibility					
- single system					
20 g DM per kg BW		46	2,2	5,4	10,8
- with functional Caecum					
2 g DM per 100 g BW		46	0,22	0,54	1,08
- multiple system					
20 g DM per kg BW		46	1,8	4,6	9,2
- poultry system		46			
0,2 g DM per 10 g BW			0,02	0,05	0,10
2 g DM je 100 g BW			0,22	0,54	1,08

Tomato

Tomatoes are mainly cultivated under greenhouse conditions. In some parts of Germany however they are also cultivated under field conditions in amounts between 2013 and 2425 ha. The harvest are amounting up to 320 dt. per ha. The digestibility of the tomato seeds is 65%. With regard to the thousend corn weight the following amount of intact excreted seeds can be calculated:

Part of the ration 20%:	0,01 g per 10 g BW	according	2 seeds per 10 g BW,
Part of the ration 50%:	0,03 g per 10 g BW	according	10 seeds per 10 g BW,
Part of the ration 100%:	0,07 g per 10 g BW	according	20 seeds per 10 g BW.

Grain

Estimation for the excreting rates of wheat corn

Values in g per bodyweight (BW)

	Digestibility (%)	**wheat**		
Part of intake	**%**	20	50	100
Typ of digestibility				
- single system	81			
20 g DM per kg BW		0,7 (3)	1,9 (9)	3.8 (18)
- with functional Caecum	81			
2 g DM per 100 g BW		0,07 (0,3)	0,19 (0,9)	0,38 (1,8)
- multiple system	77			
20 g DM per kg BW		0,92 (4)	2,3 (11)	4,6 (22)
- poultry system	72			
0,2 g DM per 10 g BW		0,01 (0,05)	0,03 (0,15)	0,06 (0,30)
2 g DM je 100 g BW		0,11 (0,5)	0,28 (1,4)	0,56 (2,8)

Estimation for the excreting rates of barley corn

Values in g per bodyweight (BW)

	Digestibility (%)	**barley**		
Part of intake	**%**	20	50	100
Typ of digestibility				
- single system	73			
20 g DM per kg BW		1,08 (7)	2,70 (17	5,40 (34)
- with functional Caecum	78			
2 g DM per 100 g BW		0,09 (0,6)	0,22 (1,1)	0,44 (2,2)
- multiple system	75			
20 g DM je kg BW		1,00 (6)	2,5 (15)	5,0 (30)
- poultry system	75			
0,2 g DM per 10 g BW		0,01 (0,07)	0,03 (0,21)	0,06 (0,42)
2 g DM je 100 g BW		0,1 (1)	0,3 (5)	0,6 (10)

Estimation for the excreting rates of rye corn

Values in g per bodyweight (BW)

	Digestibility (%)	rye		
Part of intake (DM)	**%**	20	50	100
Typ of digestibility				
- single system	79			
20 g DM per kg BW		0,84 (7)	2,1 (10)	4,2 (19)
- with functional Caecum	80			
2 g DM per 100 g BW		0,08 (0,67)	0,2 (1,65)	0,4 (3,3)
- multiple system	80			
20 g DM je kg BW		0,8 (6)	2 (16)	4 (33)
- poultry system	78			
0,2 g DM per 10 g BW		0,01 (0,08)	0,02 (0,17)	0,05 (0,42)
2 g DM je 100 g BW		0,09 (0,77)	0,22 (1,9)	0,44 (3,8)

Estimation for the excreting rates of oat corn

Values in g per bodyweight (BW)

	Digestibility (%)	oat		
Part of intake (DM)	**%**	20	50	100
Typ of digestibility				
- single system	60			
20 g DM per kg BW		1,6 (14)	4,0 (35)	8,0 (70)
- with functional Caecum	61			
2 g DM per 100 g BW		0,16 (1)	0,4 (3)	0,8 (7)
- multiple system	60			
20 g DM je kg BW		1,6 (14)	4,0 (35)	8,0 (70)
- poultry system	60			
0,2 g DM per 10 g BW		0,02 (0,18)	0,04 (0,36)	0,08 (0,72)
2 g DM je 100 g BW		0,16 (1)	0,4 (3)	0,8 (7)

Estimation for the excreting rates of triticale corn

Values in g per bodyweight (BW)

	Digestibility (%)	triticale		
Part of intake (DM)	**%**	20	50	100
Typ of digestibility				
- single system	75			
20 g DM per kg BW		1,0 (6)	2,5 (17)	5,0 (34)
- with functional Caecum	77			
2 g DM per 100 g BW		0,09 (0,54)	0,23 (1,4)	0,46 (2,8)
- multiple system	77			
20 g DM je kg BW		0,92 (6)	2,3 (16)	4,6 (32)
- poultry system	75			
0,2 g DM per 10 g BW		0,01 (0,07)	0,02 (0,14)	0,05 (0,35)

2 g DM je 100 g BW	0,1 (0,70)	0,25 (1,74)	0,50 (3,49)

Estimation for the excreting rates of maize corn

Values in g per bodyweight (BW)

	Digestibility (%)	maize		
Part of intake (DM)	**%**	20	50	100
Typ of digestibility				
- single system	79			
20 g DM per kg BW		0,84 (0,13)	2,10 (0,33)	4,20 (0,66)
- with functional Caecum	71			
2 g DM per 100 g BW		0,12 (0,02)	0,29 (0,05)	0,58 (0,09)
- multiple system	77			
20 g DM per kg BW		0,92 (0,14)	2,3 (0,36)	4,6 0,72)
- poultry system	76			
0,2 g DM per 10 g BW		0,01(0,002)	0,02(0,004)	0,05(0,008)
2 g DM je 100 g BW		0,10(0,02)	0,24(0,04)	0,48(0,08)

Rape

Estimation for the excreting rates of rape seed

Values in g per bodyweight (BW)

	Digestibility (%)	Rape		
Part of intake (DM)	**%**	20	50	100
Typ of digestibility				
- single system	81			
20 g DM per kg BW		0,76 (26)	1,90 (65)	3,8 (130)0
- with functional Caecum	81			
2 g DM per 100 g BW		0,08 (2)	0,19 (6)	0,38 (12)
- multiple system	81			
20 g DM per kg BW		0,76 (26)	1,90 (65)	3,80 (130)
- poultry system	81			
0,2 g DM per 10 g BW		0,01 (0,3)	0,02 (0,6)	0,04 (1,2)
2 g DM je 100 g BW		0,08 (2)	0,19 (6)	0,38 (12)

Cabbage

Estimation for the excreting rates of cabbage seed

Values in g per bodyweight (BW)

	Digestibility(%)	cabbage		
Part of intake (DM)	**%**	20	50	100
Typ of digestibility				
- single system	75			
2 g DM je 100 gBW		0,1 (50)	0,75 (375)	1,50 (750)
- with functional Caecum	78			
2 g DM per 100 g BW		0,09 (45)	0,22 (110)	0,44 (220)
- poultry system	75			
0,2 g DM per 10 g BW		0,01 (5)	0,08 (37)	0,15 (75)
2 g DM per 100 g BW		0,1 (50)	0,75 (375)	1,50 (750)

Mustard

Estimation for the excreting rates of mustard seed

Values in g per bodyweight (BW)

	Digestibility(%)	mustard		
Part of intake (DM)	**%**	20	50	100
Typ of digestibility				
- single system	81			
2 g DM je 100 gBW		0,08 (1)	0,19 (3)	0,38 (6)
- with functional Caecum	81			
2 g DM per 100 g BW		0,08 (1)	0,19 (3)	0,38 (6)
- poultry system	81			
0,2 g DM per 10 g BW		0,01 (0,15)	0,02 (0,31)	0,04 (0,62)
2 g DM per 100 g BW		0,08 (1)	0,19 (3)	0,38 (6)

Radish

Estimation for the excreting rates of radish seed
Values in g per bodyweight (BW)

		Digestibility (%)	radish		
Part of intake (DM)	**%**		20	50	100
Typ of digestibility					
- single system		75			
2 g DM je 100 gBW			0,1 (12)	0,75 (90)	1,5 (180)
- with functional Caecum		75			
2 g DM per 100 g BW			0,1 (12)	0,75 (90)	1,5 (180)
- poultry system		75			
0,2 g DM per 10 g BW			0,01 (1)	0,07 (9)	0,15 (18)
2 g DM per 100 g BW			0,1 (12)	0,75 (90)	1,5 (180)

Linseed

Estimation for the excreting rates of linseed
Values in g per bodyweight (BW)

		Digestibility (%)	linseed		
Part of intake (DM)	**%**		20	50	100
Typ of digestibility					
- single system		79			
20 g DM per kg BW			0,84 (11)	2,1 (27)	4,2 (47)
- with functional Caecum		71			
2 g DM per 100 g BW			0,12 (1)	0,29 (4)	0,58 (8)
- multiple system		77			
20 g DM per kg BW			0,92 (12)	2,3 (31)	4,6 (64)
- poultry system		76			
0,2 g DM per 10 g BW			0,01 (0,13)	0,02 (0,28)	0,05 (0,69)
2 g DM per 100 g BW			0,10 (1)	0,24 (3)	0,48 (6)

Lucerne

Estimation for the excreting rates of lucerne seed
Values in g per bodyweight (BW)

	Digestibility (%)	lucerne		
Part of intake (DM)	**%**			
Typ of digestibility				
- single system	83			
20 g DM per kg BW		0,68 (340)	1,7 (850)	3,4 (1700)
- with functional Caecum	83			
2 g DM per 100 g BW		0,07 (34)	0,17 (85)	0,34 (170)
- multiple system	83			
20 g DM per kg BW		0,68 (340)	1,7 (850)	3,4 (170)
- poultry system	83			
0,2 g DM per 10 g BW		0,01 (5)	0,02 (10)	0,03
2 g DM per 100 g BW		0,07 (34)	0,17 (85)	0,34 (170)

Chicory

Estimation for the excreting rates of chicory seed
Values in g per bodyweight (BW)

	Digestibility (%)	chicory		
Part of intake (DM)	**%**	20	50	100
Typ of digestibility				
- single system	75			
2 g DM je 100 gBW		0,1 (45)	0,75 (338)	1,5 (675)
- with functional Caecum	75			
2 g DM per 100 g BW		0,1 (45)	0,75 (338)	1,5 (675)
- poultry system	75			
0,2 g DM per 10 g BW		0,01 (4)	0,07 (33)	0,15 (67)
2 g DM per 100 g BW		0,1 (45)	0,75 (338)	1,5 (675)

Sugar beet

Estimation for the excreting rates of sugar beet seed
Values in g per bodyweight (BW)

		Digestibility (%)	**sugar beet**		
Part of intake (DM)	**%**		20	50	100
Typ of digestibility					
- single system		31			
20 g DM per kg BW			2,76 (96)	6,9 (240)	13,8 (480)
- with functional Caecum		31			
2 g DM per 100 g BW			0,28 (9)	0,69 (24)	1,38 (48)
- multiple system		57			
20 g DM per kg BW			1,75 (60)	4,37 (151)	8,75 (304)
- poultry system		31			
0,2 g DM per 10 g BW			0,03 (0,96)	0,07 (2,2)	0,14 (4,5)
2 g DM per 100 g BW			0,28 (9)	0,69 (24)	1,38 (48)

Horse bean

Estimation for the excreting rates of horse bean seed
Values in g per bodyweight (BW)

		Digestibility (%)	**horse bean**		
Part of intake (DM)	**%**		20	50	100
Typ of digestibility					
- single system		72			
20 g DM per kg BW			1,12 (2)	2,8 (5)	5,6 (10)
- with functional Caecum		75			
2 g DM per 100 g BW			0,1 (0,2)	0,25 (0,5)	0,50 (1)
- multiple system		80			
20 g DM per kg BW			0,08 (0,16)	0,2 (0,4)	0,4 (0,8)
- poultry system		72			
0,2 g DM per 10 g BW			0,01 (0,02)	0,03 (0,06)	0,06 (0,12)
2 g DM per 100 g BW			0,12 (0,3)	0,28 (0,6)	0,56 (1,2)

Bean

Estimation for the excreting rates of bean seed
Values in g per bodyweight (BW)

		Digestibility (%)	bean		
Part of intake (DM)	**%**		20	50	100
Typ of digestibility					
- single system		86			
20 g DM per kg BW			0,56 (2)	1,4 (5)	2,8 (11)
- with functional Caecum		86			
2 g DM per 100 g BW			0,06 (0,24)	0,14 (0,56)	0,28 (1)
- multiple system		86			
20 g DM per kg BW			0,56 (2)	1,4 (5)	2,8 (11)
- poultry system		86			
0,2 g DM per 10 g BW			0,01 (0,04)	0,01 (0,06)	0,03 (0,12)
2 g DM per 100 g BW			0,06 (0,24)	0,14 (0,56)	0,28 (1)

Pea

Estimation for the excreting rates of pea seed
Values in g per bodyweight (BW)

		Digestibility (%)	pea		
Part of intake (DM)	**%**		20	50	100
Typ of digestibility					
- single system		90	0,4 (1)	1,0 (3)	2 (6)
20 g DM per kg BW					
- with functional Caecum		90			
2 g DM per 100 g BW			0,04 (0,12)	0,1 (0,31)	0,2 (0,62)
- multiple system		90			
20 g DM per kg BW			0,4 (1)	1,0 (3)	2 (6)
- poultry system		90			
0,2 g DM per 10 g BW			0,004 (0,01)	0,01 (0,03)	0,02 (0,06)
2 g DM per 100 g BW			0,04 (0,12)	0,1 (0,31)	0,2 (0,62)

Grape

The digestibility is far under 50% caused by the high amount of lignin. Because birds and rhodents are mainly selecting the fruit pulp the seeds were destroyed in the surroundings of the stocks. Because of the small size of the seeds, they are not injured during the passing of the gastro-intestinal-tract. In partridges up to 325 intact seeds were found in the muscle part of the stomach. From the results it can be concluded, that nearly all of the eaten seeds were excreted.

Fruit seeds

The intake of fruits is mainly limited to the peel and the pulp. However when seeds are also consumed, they will be excreted without damage, especially seeds of apples, pears and quinces respectively. Fruit seeds with larger size like cherry, peach and plum are not consumed. However after consuming the will be demaged by chewing. A greater risk is the storing of these fruit seeds.

Forest seeds

Forest seeds are consumed by rhodents and birds. Values of the digestibility are not available. The main risk for the expansion of intact seeds is caused by storage. After intake the seeds were damaged.

Conclusion

From the results above it can be concluded that the risk of expansion of intact excreted seeds is high. Mainly small rhodents, which reach a population rate between 20 and 60 animals per ha and birds, which hatch pairs of 140 per km^2 are responsible for the expansion of seeds besides their different amount of habitats.

Reducing the risk of expansion of seeds from cultural plants needs precautions which are opposite to the preservation or conservation of natural beauty and wild life. The only efficient way to reduce the risk of excreted seeds is to improve the digestibility by reducing the lignin content of the seeds. To minimize the intake of seeds a minimal distance from the forest by 300 m must be taken into account. The areas should be also without hedges.