

## **Haltbarkeit von pflanzlichen Verbreitungseinheiten nach Magen-Darm-Passage**

Forschungsbericht 360 05 016  
UBA-FB 000059

von

**Prof. Dr. Klaus Männer**

Freie Universität Berlin, Fachbereich Veterinärmedizin, Institut für Tiernahrung

### **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 Ausscheidung 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, rapage, 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 nearly 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<br>(kJME/kg <sup>0,75</sup> ) | Growth | Pregnancy<br>x of maintenance | Lactation | Fly<br>x  |
|------------------|-------------------------------------------|--------|-------------------------------|-----------|-----------|
| <b>Mammal</b>    | 370 - 550                                 | 1,4    | 1,2 - 2,4                     | 2,5 - 3,5 |           |
| <b>rat</b>       | 460                                       | 1,4    | 1,2 - 2,4                     |           |           |
| <b>mouse</b>     | 735                                       | 1,5    | 1,2 - 2,4                     |           |           |
| <b>poultry</b>   | 480                                       | 1,5    |                               |           | 2,0       |
| <b>birds</b>     |                                           |        |                               |           | 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 calculated 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

| Part of intake                  | Digestibility (%) |      | Potato<br>berry |      |     |
|---------------------------------|-------------------|------|-----------------|------|-----|
|                                 | %                 |      | 20              | 50   | 100 |
| <b>Typ of digestibility</b>     |                   |      |                 |      |     |
| - <b>single system</b>          |                   |      |                 |      |     |
| 20 g DM per kg BW               | 46                | 2,2  | 5,4             | 10,8 |     |
| - <b>with functional Caecum</b> |                   |      |                 |      |     |
| 2 g DM per 100 g BW             | 46                | 0,22 | 0,54            | 1,08 |     |
| - <b>multiple system</b>        |                   |      |                 |      |     |
| 20 g DM per kg BW               | 46                | 1,8  | 4,6             | 9,2  |     |
| - <b>poultry system</b>         | 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 thousand corn weight the following amount of intact excreted seeds can be calculated:

|                                 |                    |           |                       |
|---------------------------------|--------------------|-----------|-----------------------|
| <b>Part of the ration 20%:</b>  | 0,01 g per 10 g BW | according | 2 seeds per 10 g BW,  |
| <b>Part of the ration 50%:</b>  | 0,03 g per 10 g BW | according | 10 seeds per 10 g BW, |
| <b>Part of the ration 100%:</b> | 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)

| Part of intake<br>Typ of digestibility | Digestibility (%) |             | wheat       |             |  |
|----------------------------------------|-------------------|-------------|-------------|-------------|--|
|                                        | %                 | 20          | 50          | 100         |  |
| - 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)

| Part of intake<br>Typ of digestibility | Digestibility (%) |             | barley      |             |  |
|----------------------------------------|-------------------|-------------|-------------|-------------|--|
|                                        | %                 | 20          | 50          | 100         |  |
| - 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)

|                          |    | 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)

| Part of intake (DM)      | %  | Digestibility (%) |             |             |
|--------------------------|----|-------------------|-------------|-------------|
|                          |    | 20                | oat<br>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 tritcale corn

Values in g per bodyweight (BW)

|                          |   | Digestibility (%) | tritcale    |             |             |
|--------------------------|---|-------------------|-------------|-------------|-------------|
| 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)

| Part of intake (DM)      | %  | Digestibility (%) |             |             |
|--------------------------|----|-------------------|-------------|-------------|
|                          |    | 20                | maize<br>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)

| Part of intake (DM)      | Digestibility(%) |             | mustard     |             |  |
|--------------------------|------------------|-------------|-------------|-------------|--|
|                          | %                | 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)

| Part of intake (DM)             | % | Digestibility (%) | bean        |             |             |
|---------------------------------|---|-------------------|-------------|-------------|-------------|
|                                 |   |                   | 20          | 50          | 100         |
| <b>Typ of digestibility</b>     |   |                   |             |             |             |
| - <b>single system</b>          |   | 86                |             |             |             |
| 20 g DM per kg BW               |   |                   | 0,56 (2)    | 1,4 (5)     | 2,8 (11)    |
| - <b>with functional Caecum</b> |   | 86                |             |             |             |
| 2 g DM per 100 g BW             |   |                   | 0,06 (0,24) | 0,14 (0,56) | 0,28 (1)    |
| - <b>multiple system</b>        |   | 86                |             |             |             |
| 20 g DM per kg BW               |   |                   | 0,56 (2)    | 1,4 (5)     | 2,8 (11)    |
| - <b>poultry system</b>         |   | 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)

| Part of intake (DM)             | % | Digestibility (%) | pea          |             |             |
|---------------------------------|---|-------------------|--------------|-------------|-------------|
|                                 |   |                   | 20           | 50          | 100         |
| <b>Typ of digestibility</b>     |   |                   |              |             |             |
| - <b>single system</b>          |   | 90                | 0,4 (1)      | 1,0 (3)     | 2 (6)       |
| 20 g DM per kg BW               |   |                   |              |             |             |
| - <b>with functional Caecum</b> |   | 90                |              |             |             |
| 2 g DM per 100 g BW             |   |                   | 0,04 (0,12)  | 0,1 (0,31)  | 0,2 (0,62)  |
| - <b>multiple system</b>        |   | 90                |              |             |             |
| 20 g DM per kg BW               |   |                   | 0,4 (1)      | 1,0 (3)     | 2 (6)       |
| - <b>poultry system</b>         |   | 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 rodents 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 they will be damaged by chewing. A greater risk is the storing of these fruit seeds.

## **Forest seeds**

Forest seeds are consumed by rodents 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 rodents, which reach a population rate between 20 and 60 animals per ha and birds, which hatch pairs of 140 per km<sup>2</sup> 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.