

Tab 1a. Pigs
Data Entry and Assumptions (April 26, 2018)

Farm Specific Data Entry:

- Type of manure storage
- Number of pigs for each pig category

Default Values:

- Weights in and out
 - Gestating Sow, 203 kg – 286 kg over 2 years (max 5 parities) (total sow weight gain 83 kg, annual sow weight gain 41.5 kg/year.)
 - Nursing Sow, 244 kg (average gestating sow weight, no net gain or loss)
 - Nursing Litter, 1.4 – 6.2 kg
 - Live Cull Sow, 286 kg (50% replacement rate)
 - Bred Gilt, 154 kg – 203 kg (weight gain 49 kg) plus weight of conceptus
 - Gilt (purchased), 132 kg
 - Boars, 122 kg – 299 kg
 - Weanlings, 6.2 kg – 28 kg (MAFRD COP)
 - Grower-finishers, 28 kg – 127 kg

Fixed Variables (that cannot be changed):

- Feed consumed per pig
 - Gestating Sow, 2.3 kg/pig/day (average 2.13 – 2.61 kg per day over entire gestation period and all parities, NRC 2012; 2.3 kg per day for first 28 days; 1.8 kg for 29-90 days; 2.7 for 91 to 114 days from PIC Gilt and Sow Management Manual, 2011)
 - Nursing Sow, 6.5 kg/pig/day (5.93 – 6.61 kg per day over entire lactation period, NRC 2012; 6.8 kg per farrowing crate, PIC Gilt and Sow Management Manual, 2011), Consistent with MAFRD COP
 - Nursing Litter, 0
 - Live Cull Sow, 2.3 kg/pig/day
 - Bred Gilts, 2.3 kg/pig/day (PIC Gilt and Sow Management, 2013)
 - Gilts, 3.2 kg/pig/day (consistent with PIC Gilt and Sow Management, 2013)
 - Boars, 2.5 kg/pig/day (NRC 2012)
 - Weanling, 34 kg/pig/cycle (NRC and PIC Nutrient Specifications Manual 2011)
 - Grower-finisher, 308 kg/pig/cycle
- Days on feed per cycle (Robyn Harte)
 - Gestating Sow, 121 (114 days gestating + 7 days sow is empty)
 - Nursing Sow, 21 (plus 3 days stall is empty between sows for total cycle length)
 - Nursing Litter, 21
 - Live Cull Sow, 14
 - Bred Gilts, 121
 - Gilts, 28
 - Boars, 365
 - Weanling, 52 (does not include downtime)
 - Grower-finisher, 112 (does not include downtime)
- Number of cycles for the pig place (not the individual animal, cycle length includes downtime)
 - Gestating Sow, 3.0 cycles/year (365/121, 114 days gestating plus 7 days sow is empty, place is always full)

- Nursing Sow, 15.2 cycles/year (365/24, 21 days nursing plus 3 days downtime when place is empty)
- Nursing Litter, 15.2 cycles/year (same as nursing sow)
- Live Cull Sow, 26.1 cycles/year (365/14, 50 % replacement rate, 7 days drying off plus 7 days waiting for shipping, place is always full)
- Bred Gilts, 3.0 cycles/year (same as gestating sows, place is always full)
- Gilts, 13 cycles/year (365/28, place is always full)
- Boars, 1 cycle/year (place is always full)
- Weanling, 6.9 cycles/year
- Grower-finisher, 3 cycles/year
- Protein content of feed (Robyn Harte, consistent with Feed Survey)
 - Gestating Sow, 14%
 - Nursing Sow, 20%
 - Live Cull Sow, 14%
 - Bred Gilts, 14%
 - Gilts, 16%
 - Boars, 14%
 - Weanling, 20%
 - Grower-finisher, 16%
- Milk consumption (718 g/day adjusted from Etienne et al. 1989 for faster weight gain)
 - 900 g/day
- Protein content of milk (Csapo et al. 1996)
 - 5.3%
- N retention (Shields et al., 1983)
 - Gestating Sow, 19.6 g/kg
 - Nursing Sow, 19.6 g/kg
 - Nursing Litter, 25.2 g/kg
 - Live Cull Sow, 19.6 g/kg
 - Bred Gilts, 23.1 g/kg
 - Gilts, 23.1 g/kg
 - Boars, 19.6 g/kg
 - Weanling, 25.2 g/kg
 - Grower-finisher, 23.1 g/kg
- % N excretion
 - Gestating Sow, 90%
 - Nursing Sow, 51% (Low excretion due to milk export. Note: export from the sow is the same as the intake of the pigs.)
 - Nursing Litter, 25% (Litter mostly consuming milk. Note: the estimated intake from the piglets is used to estimate the export from the sow.)
 - Live Cull Sow, 100%
 - Bred Gilts, 75%
 - Gilts, 77%
 - Boars, 94%
 - Weanling, 50%
 - Grower-finisher, 71%
- N Volatilization based on the Farm Practices Guidelines for Pig Producers in Manitoba, 1998

- P content of feed (based on CFIA Table 4 and 2013 Manitoba Feed Survey median values from Robyn Harte)
 - Gestating Sow, 0.53%
 - Nursing Sow, 0.63%
 - Live Cull Sow, 0.46%
 - Bred Gilts, 0.53%
 - Gilts, 0.46%
 - Boars, 0.46%
 - Weanling, 0.64%
 - Grower-finisher, 0.46% (Manitoba Feed Survey)
- P content of milk (Csapo et al. 1996)
 - 0.1323% (20 day average 1323 mg/kg)
- P retention
 - 5.77 g/kg, for all except weanlings (Ermias, 2014)
 - 5.0 g/kg for weanlings (low vitamin D, lower absorption)
- % P excretion
 - Gestating Sow, 87%
 - Nursing Sow, 62% (due to milk export)
 - Nursing Litter, 4% (of milk N consumed)
 - Live Cull Sow, 100%
 - Bred Gilts, 74%
 - Gilts, 68%
 - Boars, 92%
 - Weanling, 42%
 - Grower-finisher, 60%
- Pig place numbers for Sow Operations (when counting sows only):
 - Gestating sows: 84% of sow herd
 - Nursing sows: 16 % of sow herd
 - Nursing litter: Number of nursing sows x 13.2 piglets per litter
 - Live Cull Sows @ 50% replacement rate: Total number of sows (gestating and nursing) x 0.5 /52 weeks per year x 2 weeks in room
 - Bred Gilts: Total number of sows (gestating and nursing) x 0.5 /52 weeks per year x 17 weeks in room
 - Purchased Gilts: Total number of sows (gestating and nursing) x 0.5 /52 weeks per year x 14 weeks in room
 - Boars: 4% of sow herd
 - Weanlings: 13.2 piglets per litter x 0.89 survival to wean x 2.375 litters per year /52 weeks per year x 7.5 weeks in room
 - Grower Finisher: 13.2 piglets per litter x 0.89 survival to wean x 2.375 litters per year x 0.972 survival to g-f / 52 weeks per year x 17 weeks in room

Tab 1b. Beef
Data Entry and Assumptions (January 21, 2015)

Farm Specific Data Entry:

- Type of manure storage
- Number of cattle for each category
- Weight in and weight out for each category (optional defaults provided)
- Days on feed per cycle (optional defaults provided)
- Number of cycles per year (optional defaults provided)

Default Values:

- Weights in and out
 - Cow-calf, mature cows: 1375 lb (weight gain for fetus and bred heifers entering category only)
 - Cow-calf, bred heifers: 926-1238 lb (weight gain of heifer and fetus in cycle)
 - Cow-calf, replacement heifers: 581- 926 lb
 - Cow-calf, unweaned calves: 86-581 lb (weaned at 7 mo)
 - Cow-calf, bulls: 2100-2200 lb (weight gain over 4 years)
 - Feedlot, long-keep: 581-1300 lb (15 mo in feedlot, slaughtered at 22 mo)
 - Feedlot, short-keep: 975-1300 lb (finished here before slaughter)
 - Backgrounder, pasture: 793-975 lb (moved to pasture in spring)
 - Backgrounder, confined: 500-793 lb (smaller calves enter here)

Fixed Variables (that cannot be changed):

- Feed consumed per cow
 - Cow-calf: 2.5 % of weight per day as dry matter
 - Feedlot: 2.1 %
 - Backgrounder, pasture: 2.3 %
 - Backgrounder, confined: 2.7 %
- Days on feed per cycle
 - Cow-calf, mature cows: 365 days
 - Cow-calf, bred heifers: 280
 - Cow-calf, replacement heifers: 225
 - Cow-calf, unweaned calves: 210
 - Cow-calf, bulls: 365
 - Feedlot, long-keep: 240
 - Feedlot, short-keep: 116
 - Backgrounder, pasture: 105
 - Backgrounder, confined: 180
- Protein content of feed
 - Cow-calf, mature cows: 10 %
 - Cow-calf, bred heifers: 10 %
 - Cow-calf, replacement heifers: 11 %
 - Cow-calf, unweaned calves: 11 %
 - Cow-calf, bulls: 10 %
 - Feedlot, long-keep: 12 %
 - Feedlot, short-keep: 12 %
 - Backgrounder, pasture: 10 %

- Backgrounder, confined: 11 %
- Milk consumption: 5.8 kg/day (Kopp et al. 2004)
 - Milk protein: 3.8 % (Kopp et al. 2004)
- N retention : 25.6 g/kg gain
- % N excretion
 - Cow-calf, mature cows: 90 %
 - Cow-calf, bred heifers: 92 %
 - Cow-calf, replacement heifers: 88 %
 - Cow-calf, unweaned calves: 73 %
 - Cow-calf, bulls: 99 %
 - Feedlot, long-keep: 80 %
 - Feedlot, short-keep: 84 %
 - Backgrounder, pasture: 86 %
 - Backgrounder, confined: 86 %
- N Volatilization based on the Farm Practices Guidelines for Pig Producers in Manitoba, 1998
- Phosphorus content of feed
 - Cow-calf, mature cows: 0.19 %
 - Cow-calf, bred heifers: 0.19 %
 - Cow-calf, replacement heifers: 0.22 %
 - Cow-calf, unweaned calves: 0.22 %
 - Cow-calf, bulls: 0.19 %
 - Feedlot, long-keep: 0.33 %
 - Feedlot, short-keep: 0.33 %
 - Backgrounder, pasture: 0.19 %
 - Backgrounder, confined: 0.25 %
 - Milk protein: 3.8 %
- P in milk: 1.2 g/kg (midpoint 0.18 – 0.09 %)
- P retention in weight gain
 - 7.1 g/kg (7-8 g/kg range; Flaten 2003; Lynch and Caffrey, 1997)
- % P excretion
 - Cow-calf, mature cows: 83 %
 - Cow-calf, bred heifers: 80 %
 - Cow-calf, replacement heifers: 74 %
 - Cow-calf, unweaned calves: 50 %
 - Cow-calf, bulls: 98 %
 - Feedlot, long-keep: 67 %
 - Feedlot, short-keep: 75 %
 - Backgrounder, pasture: 68 %
 - Backgrounder, confined: 74 %
- Animal numbers for Cows, plus associated livestock
 - 100 cows: 85 mature, 15 bred heifers, 90 calves, 4 bulls

**Tab 1c. Dairy
Data Entry and Assumptions (August 20, 2014)**

Farm Specific Data Entry:

- Type of manure storage
- Number of cattle for each category

Fixed Variables

- Weights in and out for each category
 - Lactating cows: 635-653 kg
 - Dry cows: 653-653 kg
 - Replacements > 13 months: 367-567 kg (need to account for weight gain from 567-635 kg)
 - Calves, 4-13 months: 125-367 kg
 - Calves, 0-3 months: 41-125 kg
- Feed consumed per animal per day
 - 22.1 kg/day for a lactating cow
 - 13.1 kg/day for a dry cow
 - 0.7 kg/day for a calf (0-3 months)
 - 5.1 kg/day for a calf (3-13 months)
 - 10.6 kg/day for a replacement heifer
- Protein in feed
 - 16.5% for lactating cows
 - 11.5% for dry cows
 - 17% for calves (0-3 months)
 - 12.6% for calves (3-13 months)
 - 10.7% for replacement heifers
- % N excretion calculated from ASAE, 2005 pg 7
 - 75% for lactating cows
 - 95% for dry cows
 - 36% for calves (0-3 months)
 - 71% for calves (3-13 months)
 - 81% for replacement heifers
- N Volatilization based on the Farm Practices Guidelines for Pig Producers in Manitoba, 1998
- P content in feed
 - 0.44% for lactating cows
 - 0.22% for dry cows
 - 0.65% for calves (0-3 months)
 - 0.33% for calves (3-13 months)
 - 0.24% for replacement heifers
- P retained in milk
 - 0.9 g/kg milk (Flaten 2003; Lynch and Caffrey, 1997)
- P retained in weight gain
 - 8 g/kg (Flaten 2003; Lynch and Caffrey, 1997)
- % P Excreted (**Revised August 2014 based on MB excretion calculations**)
 - 74% for lactating cows
 - 97% for dry cows
 - 65% for calves (0-3 months)

- 72% for calves (3-13 months)
- 85% for replacement heifers
- 32 kg milk/day
- Number of Animals for Cows, plus associated livestock
 - 100 mature cows (80 lactating, 20 dry), 8 calves (0-3 months), 20 (4-13 months), 35 (>13 months)

**Tab 1d. Sheep
Data Entry and Assumptions**

Farm Specific Data Entry:

- Sheep places
- Weight in and weight out for each category (optional defaults provided)
- Days on feed (except ewes plus associated livestock; optional defaults provided)
- Number of cycles (except ewes plus associated livestock; optional defaults provided)
- Type of manure storage

Fixed Variables

- N Volatilization based on the Farm Practices Guidelines for Pig Producers in Manitoba, 1998
- N excretion (ASAE 2005; AWMFH 2008)
 - 0.45 kg N per 1000 kg live weight
- P excretion (ASAE 2005; AWMFH 2008)
 - 0.07 kg P per 1000 kg live weight
- P retained in weight gain
 - **Unavailable**
- Number of Animals for Sheep, plus associated livestock
 - 100 ewes, 3 rams, 15 replacements, 294 lambs

**Tab 1e. Poultry
Layer, Broiler Chicken and Turkey Data Entry and Assumptions**

Farm Specific Data Entry:

- Bird places
- Weight in and weight out for each turkey category (optional defaults provided)
- Days on feed (optional defaults provided)
- Number of cycles (optional defaults provided)
- Type of manure storage

Fixed Variables

Broilers

- Weight in
 - 0.05 for 0 weeks
 - 2 kg broiler breeder hens
- Weight out
 - 1.98 kg for broilers
 - 2 kg for broiler pullets
 - 3.94 kg for broiler breeder hens

- Number of eggs
 - 170 eggs for broiler breeder hens
- Egg weight
 - 65 g for broiler breeder hens
- Days on feed
 - 33 for broilers
 - 140 for broiler pullets
 - 273 for broiler breeder hens
- Cycles per year
 - 7.4 for broilers
 - 2 for broiler pullets
 - 1 for broiler breeder hens
- N Volatilization based on the Farm Practices Guidelines for Pig Producers in Manitoba, 1998
- N excretion (ASAE 2005; AWMFH 2008)
 - 0.96 kg N per 1000 kg live weight
- P excretion (ASAE 2005; AWMFH 2008)
 - 0.28 kg P per 1000 kg live weight – *to be reviewed based on retention*
- Feeding rates per cycle
 - 1.65 kg feed/kg weight gain for broilers
 - 6.3 kg per broiler breeder pullet
 - 39.6 kg per broiler breeder hen
- P retained in weight gain
 - 5 g/kg meat (Flaten 2003; Lynch and Caffrey, 1997)
- P retained in eggs
 - 2 g/kg eggs (Flaten 2003; Lynch and Caffrey, 1997)
- % P in Feed
 - 0.65%
- % P Excretion
 - Same range as ASAE (51%) for broilers

Layers

- Weight in
 - 0.05 for 0 weeks
 - 1.375 for layer hens and layer breeder hens
- Weight out
 - 1.38 kg for layer pullets and layer breeder pullets
 - 1.7 kg for layer hens and layer breeder hens
- Number of eggs
 - 306 eggs per year for layers
 - 294 eggs per year for layer breeders
- Egg weight
 - 60 g for layers
- Days on feed
 - 133 for layer pullets and layer breeder pullets
 - 355 for layer hens
 - 329 for layer breeders
- Cycles per year

- 2 for layer pullets and layer breeder pullets
 - 1 for layer hens and layer breeders
- N Volatilization based on the Farm Practices Guidelines for Pig Producers in Manitoba, 1998
- N excretion (ASAE 2005; AWMFH 2008)
 - 1.1 kg N per 1000 kg live weight
- P excretion (ASAE 2005; AWMFH 2008)
 - 0.33 kg P per 1000 kg live weight
- Feeding rates per cycle
 - 36 kg per layer hen per year
 - 34.5 kg per breeder hen per year
- P retained in weight gain
 - 5 g/kg meat (Flaten 2003; Lynch and Caffrey, 1997)
- P retained in eggs
 - 2 g/kg eggs (Flaten 2003; Lynch and Caffrey, 1997)
- % P Excretion
 - Same range as ASAE (81%) for hens

Turkeys

- Weight in
 - User input
- Weight out
 - User input
- Days on feed
 - User input
- Cycles per year
 - User input
- N Volatilization based on the Farm Practices Guidelines for Pig Producers in Manitoba, 1998
- N excretion (ASAE 2005; AWMFH 2008)
 - 0.72 per 1000 kg live weight for all hens except breeding hens
 - 0.53 kg per 1000 kg live weight for breeding hens and all toms
- P excretion (ASAE 2005; AWMFH 2008)
 - 0.20 per 1000 kg live weight for all hens except breeding hens
 - 0.16 kg per 1000 kg live weight for breeding hens and all toms
- Feed Conversion
 - 1.975 kg feed per kg weight gain for broiler hens
 - 2.075 kg feed per kg weight gain for hens
 - 2.325 kg feed per kg weight gain for heavy hens
 - 2.15 kg feed per kg weight gain for toms
- P retained in weight gain
 - **Unavailable**
- % P in Feed
 - 0.62%

Tab 2. Crop Rotation (Revised December 18, 2017)

Farm Specific Data Entry:

- Historical yields for each crop in the rotation
 - For Provincial technical review, MASC on-farm yield averages or 10-year MASC historical yields for the RM or MASC soil zones should be used.
- Average crop acreage for each crop in the rotation
- Number of acres in Hanover and La Broquerie
 - Land requirement estimates for new and expanding livestock operations are based on crop N utilization and crop P₂O₅ removal. For lands in Hanover and La Broquerie, crop P₂O₅ removal is used. For lands outside of Hanover and La Broquerie, two times crop P₂O₅ removal is used.
- Available acres for crops that are not included in the crop rotation tab, should be added under “additional acres” and the planned crop should be included in the line below.

Fixed Variables

- N uptake for each crop (MAFRD, 2009)
- N removal for each crop (MAFRD, 2009)
- P₂O₅ removal for each crop (MAFRD, 2009)

Tab 3. Farm Excretion

Output:

- Summary of N and P₂O₅ excretion for all livestock associated with the operation

Tab 4. Land Summary (Revised December 18, 2017)

Land Base Requirements:

- Acres for Nitrogen Uptake – the number of acres required to manage the manure based the estimated N excretion and N uptake of the crops in the rotation
- Acres for Phosphorus Removal – the number of acres required to manage the manure based on estimated of P₂O₅ excretion and twice crop removal of P₂O₅ for lands outside of Hanover and La Broquerie and P₂O₅ balance for lands in Hanover and La Broquerie

Phosphorus Balance:

- Number of acres required to balance P₂O₅ excretion with crop P₂O₅ removal over the course of a rotation
- Recommended in areas of high livestock intensity where land available for manure application is limited, such as Hanover and La Broquerie