



Calculating measures of productivity

Flock productivity is measured either through ratios, proportions or rates.

A ratio compares measures that do not share any animals e.g. ewe : ram ratio.

For both proportions and rates, the numerator (number on the top of the equation) is the number of sheep that are affected (e.g. lambed, culled, died, treated), and the denominator (number on the bottom of the equation) is the number of sheep that are at risk of being affected (e.g. to be a risk of lambing, the ewe must have been exposed to the ram).

A rate also requires a specified time period (e.g. day, month, year, breeding season, birth to weaning), that the animals were at risk. e.g. the culling rate is the proportion of sheep that were culled in one year.

Flock productivity over a 12-month period¹

General inventory			
Adult mortality rate	Adult ewes are most at risk of dying from predators, diseases that occur around lambing and some infectious diseases. e.g. mastitis, pneumonia, and chronic wasting diseases. Most mortality can be limited to less than 5% annually with good management practices that reduce the risk of these diseases.	# of adult sheep that die in 12 month period / average # of adult sheep in flock over same period.	Required for OSHP
Adult cull rate	Also known as removal rate . This includes all removals, including breeding sales and adults. Good managers will remove a proportion of the ewe flock that is not as productive as the new replacement stock. Most culls should be voluntary , e.g. a ewe whose lambs at weaning were not as heavy as the average of the group should be removed and replaced with a more productive ewe. Involuntary culls are because the animal is no longer productive, e.g. mastitis, infertility.	# of adult sheep that are removed from the flock in a 12 month period / average # of adult sheep in the flock over the same period.	Required for OSHP
Reproductive performance			
Ram : Ewe Ratio	Only calculate if using one breeding group in a 12 month period. Otherwise, calculate per breeding group. Different breeding management systems require different ram to ewe ratios. For example, range breeding a flock over 42 days in season may only require 1 ram per 50 ewes, whereas synchronization of the flock in or out of season may require a much lower ratio (i.e. 1 ram per 7 to 15 ewes). If reproductive performance is poor for this breeding group, use this number to determine if “ram power” may be an issue	1 : (# of ewes in breeding group / # of rams that group of ewes are exposed to)	

¹ These explanations can also be used when calculating by breeding group. A **breeding group** is defined as a group of ewes that are managed in a similar manner (e.g. hormone) and bred at the same time by the same ram(s).

Pregnancy (scanning) rate	If scanning is routinely done, this allows the producer to more quickly pinpoint problems in ewe or ram fertility or breeding management practices.	$\left[\frac{\text{(# ewes scanned for pregnancy in a 12-month period - \# of ewes scanned open)}}{\text{\# of ewes scanned for pregnancy}} \right] * 100$ <p>The calculation for this performance indicator can be further broken down to determine more specific information on prolificacy. The denominator will always be the number of sheep scanned for pregnancy.</p> <p>% scanned open % scanned with singles, twins, triplets, and more.</p>	
Lambing rate – per exposure to the ram	The proportion of the breeding group that lambs from a breeding exposure. A ewe may be exposed more than once to the ram if there is more than one breeding period included in the 12 months. This may be very close to the pregnancy (scanning) rate in value unless there is a marked problem with abortion. This figure should be greater than 95%.	$\left(\frac{\text{\# of ewes that lamb in the 12-month period}}{\text{total \# of exposures in the corresponding 12 month period}} \right) * 100$	Required for OSHP
Lambing rate – per ewe exposed to the ram	This is for producers using an accelerated or frequent lambing system in which the ewe may have an opportunity to lamb more than once per year. If fertility is good, then both lambing rates should be very close in value. If not, then it is important to analyze performance by breeding group to determine which exposure is performing badly.	$\left(\frac{\text{\# of ewes that lamb in the 12 month period}}{\text{total \# of ewes in the breeding flock in the corresponding 12-month period}} \right) * 100$	
Ewe lamb lambing rate	This reflects the fertility of the ewe lambs (ewes that have not lambed before). Poor fertility may be due to problems with nutrition, breeding management, genetics or seasonality (if bred out of season). If this figure is low (i.e. <90%), the producer may wish to examine the fertility rate of those ewe lambs exposed to the ram for the first time vs. those ewe lambs that may be been previously exposed to the ram but failed to conceive. If the former is lower than the latter, perhaps the ewe lambs have not yet reached puberty and factors affecting this should be examined. If the latter is lower than the former, there may be a group of ewe lambs that are infertile for other reasons (genetics, nutrition, etc.).	$\left(\frac{\text{\# of ewe lambs that lambed in that 12-month period}}{\text{\# of ewe lambs exposed to the ram in the corresponding 12-month period}} \right) * 100$	
Average age at first lambing (months)	This reflects the fertility of ewe lambs as well as management decisions of when to breed ewe lambs and the possible decisions on whether and	$\left(\frac{\text{Sum of ages of all ewe lambs that lambed in that 12-month period}}{\text{\#}} \right)$	

	<p>when to re-expose ewe lambs that did not conceive to the first breeding. This is a more historic view of ewe lamb fertility than ewe lamb lambing rate.</p> <p>For intensively reared sheep the average age should be between 12 and 18 months. For extensive range breeds, the figure may be closer to 24 months.</p>	of ewe lambs that lambed)	
Abortion rate	<p>Sheep are prone to many causes of abortion, both infectious (e.g. chlamydiosis, toxoplasmosis, campylobactiosis, coxiellosis), and non-infectious (e.g. iodine deficiency). Many of the causes of abortions may also cause a decrease in lambing rate (open ewes) and an increase in stillbirth and neonatal mortality rate.</p> <p>Flocks without an abortion problem have rates <2%. Flocks with endemic abortion problems have rates of 5 to 10%. Abortion storms often have rates of 20 to 30%. Abortion rates greater than 5% should be investigated by a veterinarian, particularly if abortions are clustered in time.</p>	(# of ewes and ewe lambs observed to abort in that 12 months / # of exposures during corresponding 12 months) * 100	
Lambs born per exposure to ram	<p>This is a measure of the prolificacy (more lambs per ewe lambing) and fertility (the ability of the ewe to become pregnant). Should record all term stillborn lambs as well as all live births. Targets are specific to the prolificacy of the breed used. If this figure is lower than target (e.g. 1.3 for extensive range ewes; up to 2.0 for intensive prolific ewes), then prolificacy and fertility should be examined separately.</p>	(# of lambs born in 12-month period / # of exposures during corresponding 12-month period)	Required for OSHP
Lambs born per ewe exposed to the ram (per ewe per year)	<p>For producers using an accelerated lambing program. It measures prolificacy and fertility but also measures the success of the accelerated lambing program.</p> <p>If the value for “per ewe exposed” is lower, then analyze by breeding group to determine where there is a failure of either fertility or prolificacy.</p>	(# of lambs born in 12-month time period / # of ewes exposed to the ram in the corresponding 12-month time period)	
Lambs born per lambing	<p>Also called “drop rate”, “litter size” or erroneously called “lambing rate”. This should include all stillbirths as well as live births. A low value may be due to factors that affect the ewe’s prolificacy and not necessarily affect the ewe’s ability to become pregnant. This could be nutritional, genetic, related to ram fertility, ram to ewe ratio, etc.</p>	(# of lambs born in 12-month time period / # of lambings in the same 12-month time period)	Required for OSHP
Proportion of ewes lambing singles vs. twins vs. triplets or more	<p>Although prolificacy is desired, the distribution of singles vs. multiples is also of interest. This risk of undersized lambs, ewe rejection or other mismothering issues is increased with ewes lambing triplets or more (in some breeds this may be quads or more). If the distribution is skewed so that too many ewes have large litters, the producer may wish to modify the hormonal component of the breeding program. If the</p>	(# of lambings producing singles / total # of lambings) ; (# of lambings producing twins / total # of lambings) ; (# of lambings producing triplets / total # of lambings); (# of lambings	

	distribution is skewed so that too many ewes are producing singles, other issues such as nutrition, genetics, ram power, seasonality etc. should be examined.	producing quads or more / total # of lambings)	
Length of lambing period	This reflects the length of the breeding season – usually 6 to 7 days shorter than the lambing period, and the success of the breeding exposure. A drawn-out lambing period may detract from lambing management i.e. the ability to properly attend and manage lambings	Date of last lambing – date of first lambing	Required for OSHP
Distribution of lambing within the lambing period	For flocks that only have one breeding group per year. Producers using an accelerated lambing system or that have more than one breeding group in their flock need to analyze by breeding group. During the normal breeding season (e.g. fall), the ewe has more than one opportunity to be bred by the ram (length of estrous cycle is 17 days). Most (75%) of the ewes should conceive to the first breeding opportunity. Failure to do this indicates a problem with breeding management. If the lambing season is spread out, check ram and ewe fertility issues.	Proportion of ewe lambing to 1 st cycle: (3 of ewes lambing <163 days after ram introduced / # of ewes lambing) * 100 Proportion of ewes lambing to 2 nd cycle: (# of ewes lambing 13 to 174 days after ram introduced / # of ewes lambing) * 100 Proportion of ewes lambing to 3 rd + cycles (# of ewes lambing more than 174 days after the ram is introduced / # of ewes lambing) * 100	
Lamb survival performance			
Stillbirth rate	The proportion of lambs that are stillborn (i.e. never observed alive) is a reflection of peri-partum and lambing management but, combined with an elevated abortion rate, may also indicate a problem with infectious or non-infectious abortion. The stillbirth rate is often 5% or greater by should be <2%. If elevated, routine lamb necropsies should be performed to discover the reason.	(# of lambs stillborn / total # of lambs born) * 100	Required for OSHP
Lamb mortality rates	Most mortality in lambs born alive occurs within 48 hours of birth, generally pointing to problems with late gestation, lambing, and/or post-lambing management. Infectious disease (e.g. diarrhea, pneumonia) can cause significant losses in older lambs. Pre-weaning mortality rates are often greater than 10% by should be <5%. If losses are greater, extra information will be gained by breaking down when lambs die. The divisions listed are as calculated by GenOvis. As with stillbirth problems, routine lamb necropsies should be performed to discover the reason for the losses. Note that the rates are calculated based on those lambs that die / those lambs at risk of dying at the beginning of the time period.	Pre weaning lamb mortality rate (# of lambs dying before weaning / total # of lambs born alive) Proportion of lambs dying: Birth to 10 days: (# of lambs dying before 10 days / total number of lambs born alive) * 100 11 days to weaning:	Pre-weaning mortality rate required for OSHP

