

Heinz 57 or Pure - Purebred vs. Crossbred

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Goal (learning objective)

Youth will:

- Learn the difference between a purebred and crossbred animal.
- Learn the reasons for each breeding method.
- Learn benefits of crossbreeding and the several different types of crossbreeding systems for each species.

Supplies

- Copies of Handout 1 “Purebred vs Crossbred” (make enough copies for group)
- Blank sheets of paper (at least 2 sheets per youth)
- Several different colored pencils or pens for each youth
- Flip chart paper and markers

Pre-lesson preparation

- Make photocopies of Handout 1 – enough for group
- Read/Review lesson
- Using the Ohio Beef Resource Handbook, page 6-15, figures 6.10 and figure 6.11 and page 6-16, figures 6.12 and 6.13. Refer to the Ohio Swine Resource Handbook, 17-3 for examples of swine crossbreeding systems. Most crossbreeding system examples refer to beef or swine, but crossbreeding is done in the sheep industry and goat industry. You may design systems based on those in the handbook to be ready to help youth draw their own examples of crossbreeding systems. Help youth understand they will need to learn important traits in the species they are working with to know the best system to use.

- You could also review: Crossbreeding Systems for Beef Cattle can be found at: https://www.canr.msu.edu/resources/crossbreeding_systems_for_beef_cattle_e2701

Lesson directions and outline

Share the following information with the youth:

Purebred breeding is done to maintain genetics or characteristics for specific breed purposes. For example, Angus cattle are used for carcass characteristics and hide color and those two characteristics want to be maintained. Crossbred breeding is done with the intent of combining several desirable characteristics from two different breeds. For example, an Angus bull bred to Hereford female, which are characteristically good mothers, would produce higher weaning weight calves. Offspring of these two will have several desirable characteristics appealing to the market, faster growing, heavier weights, etc. Purebred breeding is to maintain and improve genetic influences while crossbreeding can offer heterosis, longevity and profitability (refer to the Purebred vs. Crossbred supplement for more information).

Conducting the activity (DO)

Ask the youth to share what they know about purebred livestock and crossbred livestock. Have them share the difference. Ask the youth to share if they project animal they are raising is a purebred or a crossbred.

1. Ask for a volunteer to distribute Handout 1. Work with the youth to review the terminology and definitions.
2. Divide the youth into groups or assign a different youth to complete one of the activities listed below. Have youth use flip chart paper and markers or paper and colored pencils.
 - Explain or draw a two-breed terminal cross and

list the advantages

- Explain or draw a three-breed terminal cross and list the advantages
- Explain heterosis or hybrid vigor. Have them share how it can be used to increase profit in a livestock operation
- Design a crossbreeding system with a particular purpose in mind: increased growth, improved carcass traits, mothering ability, milk production, litter number, etc.
- Draw out the breeding system for the animal project they are raising. For example, if they have a brockle faced, black steer the parents could be a black Angus bull bred to a Hereford cow or if they have a red pig with a white belt the parents could have been a Hampshire boar bred to a Duroc gilt.

University Extension. Retrieved from: https://www.canr.msu.edu/resources/crossbreeding_systems_for_beef_cattle_e2701.

What did we learn? (REFLECT)

- Ask: What is the difference between a purebred and crossbred animal?
- Ask: What is the purpose for each breeding type?
- Ask: What are some of the crossbreeding systems?

Why is that important? (APPLY)

- Ask: How does purebred breeding influence the industry? What does it provide?
- Ask: How is crossbreeding beneficial?

Resources

Ohio State University Extension. (2011). Reproduction and Genetics. *Beef resource handbook* (pages 6-11 through 6-16).

Ohio State University Extension. (2008). Reproduction. *Goat resource handbook* (pages 44-48).

Ohio State University Extension. (2011). Reproduction and Genetics. *Sheep resource handbook for market and breeding projects* (pages 123-128).

Ohio State University Extension. (2000). Genetics. *Swine resource handbook for market and breeding projects* (pages 17-1 through 17-6, 15-2).

Ritchie, H. (1999). Crossbreeding Systems for Beef Cattle. *Extension Bulletin E-2701*. Michigan State

REPRODUCTION: PUREBRED VS CROSSBRED – HANDOUT 1

Terminology

Pure breeding (straight breeding): the mating of two animals of the same breed; several types.

Crossbreeding: is the mating of animals from two or more different breeds. It provides a commercial producer the chance to increase the production for each female in the herd. A well-planned crossbreeding program can increase overall performance of offspring as much as 20 percent above the average of the parents. This happens through heterosis or hybrid vigor.

Heterosis (hybrid vigor): the increase in performance associated with the crossbred animal when compared to the average of the purebred parents.

Outbreeding: the continuous use of unrelated animals. Allows one to get the maximum amount of heterozygosity in a flock or a herd.

Inbreeding: mating of a male and female that have one (or more) common ancestor(s). Examples include daughter/sire mating and dam/son mating. Inbreeding increases the number of dominant and recessive genes (homozygosity) and may result in lowered reproductive performance and decreased fleece weights (in sheep).

Linebreeding: similar to inbreeding which concentrates on continued mating of descendants of a certain animal to produce the desirable traits of those descendants.

Heterozygosity: is the way to introduce new genes into the purebred herd by using different male animals on the same females. In a way it is like heterosis only in a purebred situation.

Longevity: how long an animal stays in the herd. An animal that has the ability to produce offspring in the herd for many years.

Profitability: the ability to raise livestock that will bring a profit to the ranching or farming operation. Raising animals that will allow the producer to make money.

New breed formation: the development of a new breed from crossbreeding existing breeds

Systemic crossbreeding: involves crossing males and females of certain breeds or crosses to get a specific type of offspring. Examples: two-breed terminal crossing, three-breed rotational cross, roto-terminal cross, etc. Purpose of crossbreeding is to increase both individual and maternal heterosis.

Terminal cross: typically, animals from this type of mating are bred strictly for meat production and intended to go into the food chain not back into a herd for reproduction

Crossbreeding Systems

Examples of the following crossbreeding systems can be found in the Ohio Beef Resource Handbook, page 6-15 & 6-16 and in the Ohio Swine Resource Handbook, page 17-3. These examples could be applied in potential sheep or goat crossbreeding programs.

Two-breed terminal cross: a system in which straightbred females are bred to a bull of another breed. The cross ends with the calves. The replacement females are kept with the straightbred females. Therefore, part of the herd must remain straightbred or replacements must be purchased. The producer benefits only from the individual heterosis in the calf (no maternal heterosis).

Three-breed terminal cross: a system in which a two-breed cross female, called the "F1", is bred to a male of a third breed. This three-way cross gives the maximum amount of heterosis in both the female (maternal heterosis) and offspring (individual heterosis). The producer either raises the F1 females or purchases them. Breeds used in the cross for the females should be based on maternal characteristics (fertility, birth ease, milking ability, etc.). The breed chosen for the terminal male should complement the female breeds by excelling in fertility level, growth rate, and carcass characteristics. All the offspring from this cross are marketed, no replacements are selected from this three-way cross typically.

Crisscross/backcross: a system in which two breeds are used. Female replacements are saved from the crossbred offspring to breed back to one of the parent breeds. From then on, the replacement females are bred to males of the opposite breed of their own sire. Two separate herds must be kept. The only purchases that must be made are males. Though you do not get the maximum heterosis from this cross, the big advantage is that one can raise all their own replacement females.

Three-breed rotational cross: a system that includes the use of three breeds of sires in a rotation with the females kept from these crosses. Three breeds are chosen, and each breed is used for two or three years in a row. The females are bred to the breed of males to which they are least related. In this system, 87% of the heterosis possible is obtained.

Crossbreeding Benefits

Crossbreeding combines the desirable characteristics of two or more breeds because if selected properly, the strong points of one breed can complement the weak points of another breed. Also helps through heterosis (hybrid vigor), a phenomenon that causes crossbreeds to out-produce the average of their straightbred parents. Traits that are low in heritability are the ones that best respond to heterosis and include the reproductive phase through weaning traits. Generally, lower heritable traits, such as fertility, are enhanced through systematic crossbreeding. Highly heritable traits, such as yearling weight and carcass characteristics, are enhanced by individual selection. Much of the advantage in heterosis in traits of low heritability is obtained using the crossbred female. Crossbreeding provides commercial producers the chance to increase the total production of meat per animal in the breeding herd. In the swine industry the crossbred female is the basis for more than 95% of the commercial swine produced in the US. Crossbred females will normally produce more pigs at birth with greater livability and produce more milk, which equals heavier weaning weights. Crossbred offspring also grow faster to market weight as a result of heterosis.