

12  $F_2$  individuals. Eleven show a further reblending or are intermediate to the  $F_1$  parents who in themselves were intermediate to their parents. One, however, has apparently assumed the type of the father's mother who possessed the highest grade of any of his ancestors. The outline is very similar although the grade of the grandson is a half point less. This evidently points to Mendelian segregation, but since it is the only one of relatively few examples, no inferences can yet be drawn. It is interesting, however, to note the prevalence of blending and reblending which apparently does occur throughout consecutive generations. It should also be stated in closing that wool covering appears to be inherited entirely independent of sex difference, for reciprocal crosses gave in all instances similar results.

## DUAL PURPOSE AND TOTAL FAT PRODUCTION

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For a full century the possibility of a dual purpose cow, popularly and for advertising purposes called a "farmer's cow," has been brought to the attention of the practical farmers, the agricultural press and the agricultural college. All kinds of inducements from a calf nurse to a butter producer have been offered as bait to those momentarily discouraged with special purpose herds. The high price of land and higher cost of production has been cast as a shadow over the beef raiser particularly, and the older writers have dipped into a past when butcher and consumer were not so exacting in their demands, and resurrected, true to their beef tastes, the Milking Shorthorn. Theoretically the two-purpose animal has seemed a nearly accomplished type to the sanguine breeder, and various breeds foreign to America, have had spectacular adverts and advertising. In almost all cases mediocrity or even oblivion has greeted both breeder and breed alike. At the present day a few earnest workers still wrestle with the problem, but public favor does not uniformly claim their production. Something must lie behind the problem other than the unrestricted range and live stock outlet of the last century. The writer has looked into the subject from the standpoint of total fat production, and apparently has found one place in which efficiency may be halted.

The horse breeder and buyer is familiar with a so-called farm or general purpose horse, suitable for light draft, road work and rough field traveling, to more than a limited extent. Breeders of other classes of live stock have argued from the horseman's success that dual functions may be developed in their own animals. There lies in horses one important difference that is not found in any other class of animals. The horse's function lies in the propulsion of greater or lesser loads at lesser or greater speeds. Certain typical conformations are adapted to each kind of work, but for gradations of work between, there are proportional gradations in type and these are gradations found in nature between the "forest" and "plains" types of horses. The writer does not mean to say that these intermediate types equal the true roadster or drafter. Ample evidence that they do not is furnished by the fact that all pure breeds strive to attain only the specialized type. Only one function is involved however in the animal's work and slight changes in bone leverage really determine the class to which it belongs.

In cattle, however, two entirely different functions are involved. The production of body fat, or even its possibility, has always seemed inimical to butter fat formation. The earliest text-books on animal breeding quote this as an orthodox example of negative correlation, and the belief has been deep seated with practical breeders. At the outset then, the condition is much different than the horse and offers an entirely different aspect for the student. In one year the profitable dairy cow of mature age should bring forth 275 to 300 pounds of butter fat. This is produced in connection with 550 to 650 pounds of proteids, casein and other substances classed by the milk analyst as "solids not fat." The average daily production then would be from  $\frac{2}{3}$  pound to 1 pound of fat and  $1\frac{1}{2}$  pound to 2 pounds of solids not fat. Compared on this daily basis the beef steer shows most favorably, two year olds making from 2 pounds to 3 pounds of gain during the early part of their feeding period and distributing the fat and flesh growth in about the same proportions. As to cost of production of each, from 6 to 8 pounds of dry matter are required for 1 pound of butter fat and for 1 pound of growth per steer in the early part of his feeding.

In this connection there occurs a point in the economy of the two types that receives little consideration. The beef feeder claims that he must get from one animal almost as much gain as the dairy cow gives in butter, in order to keep them equal as producers. He forgets, however, that there is a hint of impossibility in it, for while the

dairy cow's milk is removed daily, the beef animal's fat cells become more and more fully packed. As a result the dairy cow is in a position to start over afresh after each milking, while the beef animal with its store houses gradually fuller, must either cut down its food supply or waste a good share of the nutrition in the endeavor to put the ripeness into each cell. It has been experimentally demonstrated that the last portion of fat put in the cell must be deposited under wasteful conditions of feeding or not at all. We can thus amply demonstrate that a year's beef production, or the production at the close of the feeding period cannot in justice to the steer be reckoned in comparison with the dairy cow. His physical limits bind him for long periods, while for short periods, he stands on an equal basis with the dairy cow. If placed on the long period basis, however, the first half of his work must be simply growth without full fattening development. When such comparison is made we find some 600 pounds of development whose average pound value nearly equals the pound value of total solid produced by the dairy cow.

The examination of high records offers the same conclusion. Colantha 4th's Johanna, champion dairy cow of the world produced 998.26 pounds of butter fat. Shamrock II, the grand champion of the 1910 International, gained 784 pounds in eight months and was under twelve months of age when killed. When age and time are considered the steer's record is just as outstanding. The point that the writer has been trying to substantiate with these figures, is that on a performance basis, each in its peculiar conditions, the beef steer and dairy cow are almost equal as producers, or at least, are relatively fixed in their relation.

What about the dual purpose cow in this connection? Nature almost absolutely shows that in the same animal the stimulation of one function means an atrophy of the other. Yet we are in the peculiar position of saying that our dual purpose animal must have these, and a reversible function as well, according to the needs which she must meet. Nature permits a limited degree of adaptation, but certainly not a specialization of what are apparently partially exclusive functions. The other alternative offered is that the dual purpose cow must possess a higher capacity for total production, perhaps twice that of the dairy or beef animal, and can thus profitably compete because of her greater total possibilities. The comparison may be made to the child's "see-saw" or "Teeter-totter." The fulcrum represents the inherited energy capacity of the animal and one end of the board, dairy, the other, beef production. A lifting on one end does not

raise both but the average energy capacity of the race is concentrated only on the raised end. If another see-saw or class of animals is to reach the same height on one side, its energy capacity or fulcrum must be raised so that both ends of the board, or the production, may rise together. This seems to the writer to be the case in the dual purpose cow, and while some breeders may and do have animals whose steers win favorable places in the International carcass contest, and whose cows produce with the average of good dairy cows (reference is made to the herd of Red Polled cattle of A. P. Arp, Eldredge, Iowa), yet the fulcrum of his herd, the total energy capacity, must lie far above that of his special purpose competitors. This then would explain why the economies of the past have not permitted as great a development and would also account for the relative infrequency of such animals when their average performances (from a special purpose standpoint) must represent so much greater an inherent capacity.

Turning now to sheep, we find the same condition obtaining. From lamb to yearling form, the well fed sheep will develop about 100 pounds of which 20 to 24 pounds is fat. In wool sheep the fat is represented by a heavy oil secretion, which furnishes as strong a drain on the food supply as does fattening. From 18 to 25 pounds is produced by the best wool types yearly. Six to seven pounds are found in a 12-pound fleece on shearing, and the remainder is removed by evaporation, rain and contact with objects, such as pens and buildings, during the year. The government is conducting an experiment for a muttoney wool sheep near Laramie, Wyoming, and the Iowa experiment station has, by crossing, produced a flock of similar nature but of a more economic character. However, the same comparison obtains even here, and strong variations which come near to the special purpose animal, are accompanied either by a decrease in the other function or else such an outstanding nature individually that they are proportionally comparative only to the best of the special purpose animals.

It must not be assumed that the writer is zealously opposed to a dual purpose animal. It is only in search of a physiological explanation for the slow growth in popularity that this idea was conceived, and it may not have the importance the writer believes. It seems unquestionable, however, that some influence must result and the suggestion is offered only for what it is worth.