bushels, showing an average increase of one bushel in favor of detasseling. On plat B, there was an average decrease of 4 bushels. Thus, the first year's results are similar to those commonly reported from a single year's experiment in detasseling corn. On the other hand we have obtained some very striking results in 1903 and 1904, when we have the effects due to breeding for one and two years, respectively. In 1903 the average yield of 44 tasseled rows (including both plats) was 70 rows, an average increase of 13 bushels in favor of detasseling. In 1904 the corresponding yields were 76 and 87 bushels of corn per acre, making an average increase of 11 bushels in favor of detasseling. This evidence in favor of detasseling the rows which are to furnish future seeds seems so conclusive that we are now detasseling alternate rows in our corn-breeding plats, and selecting all seed ears from detasseled rows only, and, in order to obtain the greatest possible benefits from cross breeding of plants of no relation, or the most distant relation, we have worked out and adopted a mathematical arrangement of seed ears for planting which is designed to maintain continuously these desirable conditions.

FORM vs. PERFORMANCE IN BREEDING.

By A. J. GLOVER, *Associate Editor, Hoard's Dairyman.*

I did not fully realize the import of this subject until I began to analyze its meaning. *Form* means the shape and structure of anything which gives it individuality or distinctive character. Performance is achievement or execution. Since form is the result of execution, I cannot see why these two words, "form" and "performance," should enter into any law suit, so I have taken the liberty to change the wording of the subject to "*Form and Performance.*"

Underlying all difference in the inherited performance in man, and in cattle, dogs, and other domestic animals is temperament, which determines form, and form governs function. We have dairy temperament, beef temperament, and that nebulous middle temperament, broken in the power of prepotency, in the so-called dual-purpose cow. The speed function of the running horses establishes form which corresponds to inherited function which determines form. In foods, the meat-forming temperament and the fighting temperament have produced widely different forms. Every function in nature has its corresponding form which is supposed to be in harmony with its function. It would be absolutely impossible for an Angus cow to exercise the same function as the Guernsey. It would be just as impossible for the Jersey to exercise the function of the Holstein. No one would ever think of hunting prairie chickens with a bull dog or going on a fighting tour with a pointer. If anyone were so disposed he would very quickly find out that his machine was

not in harmony with its functions. Who ever heard of a breeder of trotting horses breeding to a Percheron in order to get increased speed? But we very often find dairymen hunting butter with a beef sire. There is no other class of breeders which pays so little attention to temperament and purpose as do dairymen, and, yet, whenever I find a dairy cow of decided and distinct specialty of purpose and function, she has an agreeable temperament, no matter to what breed she may belong. The men of wisdom have seized hold of these truths and have established heredity with more or less certainty of reproduction in a certain line.

There has been considerable discussion in regard to the most important law in breeding. Some authorities hold that the law that "like begets like" is the most important, while others think that the law of variation should be placed first. If it were not for the law of variation we could not improve our live stock, and by the law of "like begets like," we perpetuate more or less the variation.

In the wild state the brute mother simply supplied her young with milk, and this being accomplished, her maternal functions ceased. Man had not taken possession of her, and she only yielded enough nourishment to feed her young. In the years that have gone by there have been many changes in the relation of man to the animal creation. The wild mother, who, in centuries past, was able to protect and support her progeny, has, through man, become entirely dependent upon him for her existence. By the hand of man she has developed into an individual that not only produces enough milk to rear her young, but also provides bountifully to the support of the human family. In this wonderful transformation from the supporting of one to the supplying of many, her form has undergone a perceptible change and her increased milk flow is not due entirely to her comparatively quiet life and to a better system of feeding. If this were true, the beef cow would produce milk and butter in quantities equal to those of the dairy animal. It is a well known fact that many of the so-called highly developed beef animals do not give enough milk to raise properly their young, though they are given not only all the comforts that it is possible for man to give to any beast, but the best ration that can be compounded by the most skillful feeder.

It would seem, then, that the milk-giving proclivities of the dairy cow must be due to something more than simply feed and good care. There is still back of these two important factors a great fundamental, *i. e.*, selection for a particular thing. Darwin says: "Changed habit produces an inherited effect, as in the period of the flowering plants, when transported from one climate to another." With animals the increased use or disuse of parts has had a more marked influence, thus I find in the domestic duck, that the bones of the wing weigh less and the bones of the leg more, in proportion to the whole skeleton, than do the same bones in the wild duck, and this change may be safely attributed to the domestic duck flying much less and walking more than the wild parents. The great and inherited development of the udders in cows and goats in countries

where they are habitually milked, in comparison with those organs in other countries where they are not milked, is probably another instance of the effects of use. From this it is plain that use and selection are important factors in the development life. In the beginning there was undoubtedly an unconscious selection of animals and not with any preconceived notion of type. The farmer unconsciously, perhaps, selected calves from mothers which he thought were the best milkers, thereby propagating the best. No man had any wish or expectation of permanently altering the form of the breed. Nevertheless, we may infer that this process continued during centuries, would improve and modify the conformation of any animal, in the same way as Bates, Collins, etc., by this very same process, only carried on more methodically, did greatly modify even during their lifetimes, the forms and qualities of their cattle. The selection for years of the best milking animals, and the constant demand of man for more milk has now unquestionably established a definite type known to belong to the milking strain of cattle. Whether the selections or the standards used are the best it is not necessary to discuss. Suffice it to say that, through years of constant milking the domesticated animal produces considerably more milk than her wild ancestors and she has a very much modified form.

During all this time the animal has been called upon to do much harder work than her ancestors, consequently through use she has developed certain organs, that might have been called abnormally large and even artificial, while, on the other hand, through disuse, certain portions of her body do not show the development found in her ancestors. These undeveloped portions have caused the parts which are used by her, in the manufacture of milk, to stand out clearly marked and well defined, as compared with her sister whose whole function is to make beef. The dairy cow's special function has developed four main systems which are actively engaged when the animal is producing milk, (1) the digestive organs, (2) the circulatory system, (3) the nervous system, and (4) the milk secreting system.

On account of these four active systems, the domestic animal has changed her form, and she tends to become wedge-shaped and spare and angular. Perhaps, it is not necessary for a dairy cow to become this shape, but, the majority of them are, and it is plain that this form is the result of the kind of labor that the dairy animal performs. It was Professor Haecker who brought before the public the relation of type to performance and proved without doubt that the spare and angular cow is superior to the fleshy and to the one lacking in depth of body. Notwithstanding the immense amount of experimenting that has been done to prove this, it too often happens that in the show ring fancy points are placed ahead of utility.

During the three years' field work which I did in Illinois, 644 cows completed a year's record; of these 422 have records for one year, 178 for two years and 44 for three years. With all these records, together with what I have observed visiting the best herds in northern Illinois, I have not changed materially my idea in regard to dairy

form, but, on the other hand, it has been confirmed. Nevertheless I have records of high-class dairy cows as regards form, which have been poor producers, and of other cows, not of the dairy type which have been fine producers. The great majority of cows that have proven themselves good performers at the pail have also conformed very closely to the accepted dairy form.

However, I wish to state that the ideal dairy form admits of considerable flexibility and that better results will be obtained by not adhering too closely to any fixed type. In order to be guided safely it is necessary to rely upon the scale and the Babcock test. With their use we can deviate from the rigid type when results will support us in the change. There is nothing about the dairy form that the dairy breeder worships, but he wants an individual that will yield the greatest amount of milk or butter fat for the food consumed. This should be the prime object of the breeder, but, there are only a few of them that are keeping a yearly record of their herds so that they can know the cow that is actually doing the best work. It is to be regretted that more breeders do not see the importance of being guided by records made by the animal, rather than relying upon their judgments in the selection of the best producers.

The function of the dairy cow is to make milk, not the juicy steak. She is an individual that is kept to take the grains and roughage of the field and convert them into milk. To do this successfully she does not need the wide back or heavy hind- and fore-quarters. They are a burden to her, for these parts would call upon the digestive organs for food and she needs her whole energy and vitality to carry on the labor that she is supposed to perform. In view of the special labor that she has to do, her type is entirely opposite to that of the beef animal, and she is what she is because of the four active systems that are engaged in making milk. It is through use that she has developed such a large capacity for digesting and assimilating large quantities of food and then transforming them again into human food.

While it is true that breeding for a special function develops greater power of performance, yet in many cases inferior animals are born and retained in the herd simply because they are full-bloods, and the results are that many poor animals are found in each breed of dairy cattle. I think that I am safe in saying that many breeders pay more attention to pedigree and breed characteristics than they do to form and performance. I present herewith a record of a pure-bred Holstein to illustrate what I mean.

Yearly record of Joe's Bride for three years, and average production for that period.

Year's work.	Age.	Milk.	Fat.	Fat.	Butter.	Days in milk.
	<i>Years.</i>	<i>Pounds.</i>	<i>Per ct.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
First	9	5,136	3.00	145	180	275
Second	10	3,984	2.91	116	135	274
Third	11	5,194	3.00	156	182	280
Average for three years.		4,771		139	162	276

This cow's calves are sold at fancy prices simply because she is a full blood and not because she is a good producer. I sympathize with those who are led to place too much dependence upon pedigree and breed characteristics rather than upon what the animal actually is capable of doing and what her ancestors have done before her.

General Burchard, Associate Editor of Hoard's Dairyman, gave in an address to the dairymen of Wisconsin what he called "The Cow Breeder's Shorter Catechism," which is as follows:

- Q. How many kinds of cows are there?
- A. Three.
- Q. What are they?
- A. Dairy cows, beef cows, and combination cows.
- Q. What is a dairy cow?
- A. One that has the ability to turn all the food she may eat and digest, over and above that required for maintenance, towards the udder, there to be transformed into milk.
- Q. What is a beef cow?
- A. One that turns her surplus food into flesh and fat.
- Q. What is a combination cow?
- A. One that tries to take both forks of the road and never gets anywhere.
- Q. What causes this difference in cows?
- A. Heredity.
- Q. What is heredity?
- A. "The biological law by which living beings tend to repeat themselves in their descendants."

This catechism comprehends all the principles involved in breeding a herd of dairy cows. It is not my fault that they are neither new nor peculiar. Every farmer who raises oats, hay, wheat, or corn, practices these principles with more or less attention and confidence. Let it be known in any township that John Smith has a variety of oats that for years has yielded 10 bushels more per acre than any other oats in that vicinity, and straightway dozens of other men will want some of John Smith's oats for seed. Is this wisdom or foolishness? Wisdom, most certainly. Why not, then, apply the same kind of wisdom to the breeding of dairy cows? Why not get good seed?

A good way to find out the merits of a dairy animal when giving milk is to use the scales and the Babcock test. From weight of milk produced, per cent of butter fat, length of her milking season, and cost of the feed consumed, the value of a cow for the dairy can be determined. A good dairy animal should be selected for the amount of milk and butter that she produces during the year rather than on breed characteristics and points of fancy. Of course, if she is a good breeder, that should be taken into consideration. About the most reliable basis of calculation as to the power of transmission is the dairy character of grandmothers and great grandmothers on both sides of her pedigree. The quality of her ancestors will have more effect on her offspring than she will have. She gives to her progeny of what she inherited more than she does of herself. She may be rich in inherited qualities, and yet, for some reason, be herself only an ordinary performer. On the contrary, she may be a large performer at the pail simply as a sport, but not

having a strong tide of inheritance, in a dairy direction she has nothing to convey to son or daughter. This will explain why so many Shorthorn cows that are large performers themselves fail utterly to convey their own dairy quality to their progeny. Their line of breeding is from beef heredity for many generations and they give to their progeny what they inherited. A cow breeds from her blood, not from her udder. If we are to breed our animals intelligently, a yearly record must be kept of each one for a series of years, and before eliminations are made, constitution, form and the productive powers of each animal's ancestry must be taken into consideration. So we must have dairy pedigree as well as dairy performance in order to select our dairy stock with the highest degree of wisdom. Permit me to state again that the scales and Babcock test are but very approximate guides in determining the true value of the dairy cow, and must be used with intelligence and with the greatest degree of care, if the best results are to be obtained.

The Danish farmer has probably made more use of the scales and the Babcock test in the breeding of his cows than any other man in the world. Control societies were started in 1895, and now there are more than 300 of these societies. Each society is composed of a limited number of farmers, which employ a man to make a one day's test of each cow in the herd every two weeks during her period of lactation. This work has cheapened the cost of producing butter more than one-third and has increased the profit from \$6 to \$15 per cow per year, and it costs yearly only 40 to 60 cents per cow to make the test. If the same increase could be brought to Illinois, it would amount to from \$6,000,000 to \$15,000,000 per annum. The work that the University of Illinois has done in this State bears similar testimony to that being done in Denmark by the farmers and with some help from the government. I will give you the results from a few herds that were tested by the Illinois Experiment Station:

Herd A was composed of natives, grade Holsteins and grade Shorthorns, which were by no means of the dairy type. The records plainly show that this herd was not of the dairy temperament and were not capable of giving large yields of milk and butter. The average yearly record of herd A for two years and average production for that period is given.

Record of Herd A.

Year's work.	No. of cows.	Milk.	Fat.	Fat.	Butter.
		<i>Pounds.</i>	<i>Per ct.</i>	<i>Pounds.</i>	<i>Pounds.</i>
First	18	3,970	3.55	141	164
Second	14	5,255	3.82	201	234
Average for 2 years		4,613	3.71	171	199

The herd in the second year gave 1,285 pounds more milk and 60 pounds more fat per cow than it did in the first year. The increase was due to selection and better feeding.

Let us now note the yearly record of herd E which contained cows of dairy temperament and form. The average yearly record of herd E for three years and the average production for that period are given.

Record of Herd E.

Year's work.	No. of cows.	Milk.	Fat	Fat.	Butter.
		<i>Pounds.</i>	<i>Per ct.</i>	<i>Pounds.</i>	<i>Pounds.</i>
First	7	6,474	4.19	271	316
Second	7	6,413	4.14	266	310
Third.....	10	7,168	3.94	282	330
Average for 3 years		6,685	4.08	273	318

The herds show very clearly the importance of selecting a machine that will be in harmony with the function that it is to perform.

I wish now to call your attention to the results of a Holstein herd. During the first year of the test the herd contained a great many inferior cows, notwithstanding the fact that they were all pure bred. At the end of the first year one-half of the herd was disposed of and new cows were purchased to take their places. The average yearly record of Herd F for three years and average production for that period is given.

Record of Herd F.

Year's work.	No. of cows.	Milk.	Fat.	Fat.	Butter.
		<i>Pounds.</i>	<i>Per ct.</i>	<i>Pounds.</i>	<i>Pounds.</i>
First	14	5,846	3.32	194	227
Second	17	7,171	3.29	236	275
Third.....	17	8,645	3.34	289	337
Average for 3 years		7,220	3.31	239	279

It means much to me when I note in the first year that this full-blood herd produced but 227 pounds of butter per cow, and in the third produced 337 pounds of butter per cow. This increase is not due to extravagant feeding, but purely and simply to the selling of many poor animals, to a more intelligent system of breeding, and to judicious buying and selecting.

Perhaps I have given enough records to show the importance of every breeder of dairy cattle using the scales and Babcock test as guides to the breeding of better cows. In order to make their value more appreciated I will present the records of two Holstein cows that belonged to the same herd.

Cow No. 32, Herd "R," gave in one year 8,588 pounds milk, average test 3.81 per cent; 382 pounds of butter, net profit \$36.98. She charged 45 cents to produce 100 pounds of milk and 11.8 cents to make one pound of butter fat.

Cow No. 18, Herd "R," gave in one year 9,272 pounds of milk, average test 2.57 per cent; 278 pounds of butter, net profit \$24.32. She charged 37.5 cents to produce 100 pounds of milk, and 14.6 cents for one pound of butter fat.

In comparing cows Nos. 32 and 18 it is interesting to note the great difference in their test. Who could have guessed by simply milking these two cows that No. 32 would have made 104 pounds more butter than No. 18? Which one of these animals would be the better to select the calves from for the dairy? It is reasonable to suppose that any one would select the calves from No. 32, for she produced nearly as much milk as cow No. 18, besides, it tested 3.81 per cent fat, while the milk from cow No. 18 was much below standard only testing 2.57 per cent fat.

Will it not pay the breeder to know these facts? The record of cow No. 32 shows that it is possible to have a herd that will give a large flow of good standard milk. But how shall a herd of this kind be obtained without weighing and testing each cow's milk? It is quite as important to know the good testing individuals as it is to know the ones that produce large flows of milk. The quality of the product as well as the quantity that the cow produces should always be considered when selecting calves for the future dairy.

Our State Experiment Stations and the Department of Agriculture at Washington should try to organize the farmers into societies for the purpose of testing their herds. We have ample facts to prove the great benefit that would be derived if every dairyman in the country would be guided by records in the selection of his dairy cows. What a folly it is to retain animals in the herd simply because they are pure bred and conform to breed characteristics, when they do not produce as much milk and butter fat as the so-called scrubs. Will the time ever come when the breeder of dairy stock will refuse to be governed in selection and retention of fancy points rather than physical structure, which is the basis of function and capacity in any given direction?

Many a good performing Jersey has been turned into the show ring simply because she had a mealy nose and many a Guernsey because she had a dark nose. The question before the dairy breeders to-day is not how to retain fads and beautiful markings of dairy cattle, so much as it is how through breeding to increase the productive capacity of the cows. If the dairy breeder can retain fads and beautiful markings of his breed and at the same time increase the performance of his herd there can certainly be no objections, but I earnestly urge that the breeder pay more attention to performance than to the fancy points.