tained 6.86 per cent. water. Using the unit of 16 square feet—the area dug—for computation, it was found that an acre contained 1,991 lbs. of air dried roots, containing 6.86 per cent. of water. Computed at the average amount of water found in air-dried hay—14 per cent.—the amount per acre would be 2,156 lbs.

Estimating the composition the same as that found in the former experiment it would show that the value of these young clover roots in the wheat stubble was $8.00 per acre. That is to say; the plant food they contained could not have been purchased on the market in the form of fertilizers for less money. The tops of this clover were not determined. It was estimated that they would produce a ton of hay per acre.

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Raising Horses on Grain Farms.
[By Prof. I. P. Roberts, Cornell University, N. Y.]

In America horse-power is cheaper than steam power in cultivating the land. I judge nine-tenths of all the farmers who occupy the heavy wheat lands have either too few, too small or too unproductive horses. To make clear how I would remedy this we will take for example a farm which, according to present methods, requires four able, mature horses and upon which the farmer imagines he cannot afford to keep any more. To get started suppose we change these four work horses for four good, common or mixed blooded brood mares and two 3-year-old fillies, paying the difference by note or money. The mares should be bred so as to drop their colts in late fall or early winter. The team of 3-year-olds should be kept for driving and light work. In four years one span of horses will have been sold and if fairly successful and no other sales have been made, there will be on the farm, allowing for a loss of twenty-five per cent. of the increase, four brood mares, three four-year-olds, three three-year-olds, three two-year and three one-year-old colts, or the equivalent of these.

In some groups there may be four and in some but two in all twelve colts, three of which will be able to do nearly full work, and three more able to do fully half a mature horse's work. Now, when the rush of work comes, there are the equivalent of four good teams available, and this is just the time when the boss should lay off his coat and cuffs and follow the old mares, if he can't keep up with colts for every day's work added to the cultivation, and every day's work in the right time, instead of the wrong time, always means full pay, and frequently $10 to $20 per day, for these few additional days' work. The half-blood steer unfattened, at three years, will weigh 1,100 pounds, and can be sold for $44. The half-blood French colt, at the same age, unbroken and ungrained, will weigh 1,000 pounds, and can be sold for $150. The steer, at four, after he has eaten from forty to fifty bushels of grain, will weigh 1,500 pounds, and will bring $82.50 at the farm. The colt will earn all he eats after he is three years old, and at four years will weigh 1,300 pounds, and sell for $250. From this deduct $20 for cost of service, and it will appear that while your cattle brought 4 cents your horse brought 13 cents per pound; 1st cattle 5½ cents; 4-year-old horses with board bill paid 18 cents per pound.

These are no fancy figures, but those reached by us on the university farms. Our experience in the rearing of fall or winter colts proves that it is no more difficult, in fact less so, than to raise them in warm weather. If one has learned how to keep a cow warm and make her give milk in the winter, then he knows how to make colts grow in cold weather.

The utmost care should be taken in the selection of the brood mare. Now, large numbers of "dung-hill" mares, bred sometimes to good stallions, but more often to poor ones as the quality of the mares will not justify the owner for paying as much for the services of the horse as a poor colt will be worth at one year old. "Scrubs" or "weeds" of mixed or even pure bloods are more apt to transmit their undesirable qualities than the best pure bloods are to transmit their desirable ones. The brood mare should be strictly feminine in appearance so much so that she can be distinguished at first glance from the geldings. She must be close to the ground if her off-spring are to do the world's work at the smallest cost. Short-legged horses almost invariably have broad, strong, well-made limbs and firm textured feed. The whole bony structure should appear firm and strong without being, in the least, coarse. The neck
should appear small, viewed from above. From the side, it should appear small at the head and broad at the shoulders. It should not be set on the end of the body like a pig’s, but well back on the withers. A slight crest adds beauty, if not so large as to give a masculine appearance and characteristics. A “ewe-necked” animal may sometimes be a good and a pleasant driver, but as a rule, better select those that have their necks set on right side up.

The hind quarter should be broad, long and rather sloping. If the rump is too straight the hind limbs are liable to be the same. Then follows the pounding motion that produces spasms and ring bones. If the rump is short the leverage of the hind parts is too short, the stride restricted and the walk and the trot must therefore be slow and labored. There should be great breadth of loin and hip in order to give power to the end of the horse that does all the pushing and also to give ample pelvis capacity. The shoulders should be rather oblique, blades thin, the reverse of meaty, the withers high and rather sharp, the shoulder points not prominent nor too far apart. Lung room should be secured in the schooner-shaped breast which can hardly be too prominent. Flat-breasted and flat-ribbed horses seldom have the ideal lung power. It is hardly necessary to say that the back should be short, the lower line long and the loines strong. While the animal should not be “too open,” neither should she be ribbed up like a pony. A brood mare should never be pony shaped unless it is a pony brood mare. The abdomen should be ample, especially of the old brood mare. The ideal color is a strong bay with dark points. The head, eyes, etc., why describe them? They are never bad on the mares of the type I have described.

How can we get them? There are always a few really valuable brood mares of mixed or common brood in each county. If none of these can be procured their offspring certainly can. A moderately good, tried, brood mare may cost $175, the best $300.

The difference in the value of the colts of the two mares in a single year is quite likely to be more than the difference of the cost of the dams. It will take some little time to learn what one wants and how to get it. I judge the grain farmer does not want trotters nor pure draft horses, but business horses that will sell any day except Sundays. Business men who are willing to pay a round price for a round, sound horse, are not given to Sunday horse jockeying. There are places for both extremes, the trotter and the heavy draft. The farmer would do well to choose the golden mean.

What shall the stallion be? First, masculine, strong and vigorous rather than stylish. Lofty, long, slim-necked, long-backed and long-legged, “showy” first premium horses are too often the sire of third premium colts. We have a few large stallions from the trotting strains with too much business in them for the race course, too compact and firm and good natured even for the 2:10 agricultural “horse trot.” The heaviest, shortest legged French coacher might also be used. The get of either of the above, from dams of size and substance, would make the ideal farm horse, except upon the heaviest clay lands. The lighter and smaller ones would make roadsters and single and double carriage horses, good for ten years at light work, and if well used serviceable for six to ten more on the city delivery wagon or street car.

Good stallions are found among the draught breeds. The Norman Percheron furnishing the larger number for the kind of breeding I have designated. There is a good market in the cities for very large horses, provided they have good feet and limbs; but they are very difficult to breed, and when bred they are too heavy for American farm work, and too slow for the high-strung American farm boy. In selecting the stallion from draught breeds, there is great danger that a lofty crest and size will so captivate that the plainer and more valuable qualities will be lost sight of. There is one safe rule that will seldom lead, even the novice, astray in the purchase of a horse of any kind or style. Choose a little below the medium of the large breeds and a little above in the smaller breeds. Let the showmen deal in monstrosities and put quality always before style. Good quality seldom means really bad style. A lofty crest will hardly compensate for a curbed leg.

Well matured fillies should be bred at 2 or 2½ years old and they should not be put at hard work till after they are 3 years old. Difficulty is sometimes experienced in getting the mares to re-
ceive the males late in the fall or winter. To obviate this to some extent the mare should be kept on low diet till sometime in February; then if put in a warm stable or blanketed and liberally fed and well cleaned they will come in season whenever the weather remains warm for a few days. The duration of pregnancy in the mare is about eleven calender months, and as she conceives with very great certainty, on the ninth day after dropping her foal the time of the birth of the colt may be advanced, on an average, twenty days each year. With a little care the time of breeding may be changed in a few years to suit the conditions of the breeder. Mares in foal are better off for being worked moderately, but they should not be used on very soft ground or in deep mud; neither should they be put to excessive load or at work that requires quick motion.

Pregnant animals of all kinds are liable to be more or less constipated during the latter period of pregnancy, hence, bran mashers, roots and other light laxative foods should be used largely. Timothy hay, especially if over ripe, should be fed, if at all, in limited quantities. Constipation and hard, unyielding muscles cause more trouble and loss at parturition than all other deleterious influences combined.

Milk in its natural state is composed largely of water (87 per cent.) so it stands to reason that the mare that gets but dry timothy and is watered at most twice daily cannot raise a good colt. Milk also contains a large proportion of nitrogen, and if the colt is to be properly nourished the dam should receive an abundance of roots, bran, oats and a little oil meal and bright clover hay. If properly fed and taught to eat in its own manger the colt will be ready to wean at three months old. The living colt will not only be the better but the one in utero also, and the mare will be more certain to breed regularly than if juggled down with a long and continuous nursing. When the dam is at work the foal should never be allowed to follow her, but should remain in a box stall.

Carried off the farm by a $200, 1,200-lb horse:
By $200 worth of wheat, 1,500 lbs: Nitrogen, 33.28 lbs at 16 cts., $53.25 Potash, 84.8 lbs at 5 cts., 4.24 Phosphoric acid, 126.4 at 8 cts., 10.11
Total, - - - $67.60
The bran from $200 worth of wheat carries off: (5,300 lbs. in 16,000 lbs. wheat.) Nitrogen, 118.7 lbs at 16 cts., $19.00 Potash, 75.79 lbs at 5 cts., 3.79 Phos. Acid, 144.69 lbs at 8 cts., 11.57
Total - - - $34.36
If the bran is returned to the land then $200 worth of wheat would remove but $33.24 of plant food.
Burrer. 500 lbs. at 25 cts., value $200, carries off the farm: Nitrogen 5.68 lbs at 16 cts., $.91

Principles of Breeding.
[By J. McLain Smith, Dayton, Ohio.]

It was a prevalent opinion a few years ago, resulting doubtless from its political associations, that all men are created equal; equal, that is, not only in rights, but in natural aptitude and capacity. Of those who combined to organize the Republican party, a very large proportion sincerely believed that if you would take a hundred colored children and a hundred white children, and submit them all to the same training and afford to all the same opportunities, the two races would arrive at substantially the same goal—that the colored children would make, on an average, as moral and intelligent men and women as the white children. Nothing can be more erroneous or more directly opposed to the uniform experience of mankind. Not only are there broad and marked race characteristics which no training can obliterate; but, even in the same race, there are family traits and personal peculiarities, disposition, aptitudes, capacities, even tricks of manner, which are transmitted from generation to generation with almost equal certainty. To say that the accumulations of the race consist wholly in material things and not also in inherited aptitudes and capacity, is to ignore, alike the facts of existence and the teachings of religion. Given a child, whose ancestors for many generations have been intelligent, cultivated, moral people, and you may educate him as you please, or neglect him as you please, he will almost certainly turn out an intelligent, upright